North Carolina State Library

MAY 20 1775

Digitized by the Internet Archive
in 2014

http://archive.org/details/economicpapers1621unse

REPORT OF CONVENTION CALLED BY GOVERNOR R. B. GLENN TO INVESTIGATE THE FISHING INDUSTRIES IN NORTH CAROLINA

COMPILED BY
JOSEPH HYDE PRATT

NORTH CAROLINA GEOLOGICAL AND
ECONOMIC SURVEY

JOSEPH HYDE PRATT, STATE GEOLOGIST

ECONOMIC PAPER NO. 16

Report of Convention Called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina

COMPILED BY
JOSEPH HYDE PRATT

RALEIGH
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS
1908

GEOLOGICAL BOARD

Governor R. B. Glenn, *ex officio Chairman*	Raleigh.
Henry E. Fries	Winston-Salem.
Frank R. Hewitt	Asheville.
Hugh MacRae	Wilmington.
Frank Wood	Edenton.

Joseph Hyde Pratt, State Geologist	Chapel Hill.

LETTER OF TRANSMITTAL

Chapel Hill, N. C., November 10, 1908.

To his Excellency, Hon. R. B. Glenn,
Governor of North Carolina.

Sir.—The convention which you called to investigate the condition of the fishing industries in the State convened at Morehead City, August 26, 1908, and spent the following three days in a careful and thorough investigation of the condition of the fin-fish and shell-fish industries, and have recommended such legislation as they considered advisable to more thoroughly protect and conserve these fishing resources and increase the value of our fishing industries.

The proceedings of this convention, which have been compiled by its Chairman, are hereby respectfully submitted, and I would recommend that it be published as Economic Paper No. 16, of the North Carolina Geological and Economic Survey.

Yours respectfully,
Joseph Hyde Pratt,
State Geologist.

CONTENTS

PAGE
LETTER OF TRANSMITTAL 5
INTRODUCTION 9
REPORT OF MEETINGS 10
  Resolutions Presented 13
    Beaufort County 13
    Cumberland County 13
    Currituck County 14
    Dare County 14
    New Hanover County 14
    Pamlico County 15
  Report of Fish Commissioner 15
  Resolutions Adopted by Convention 21
    Dutch-nets in Pamlico River 21
    Game Warden's Right to Search Vessels 22
    Dutch-nets in Carteret County 22
    Dutch-nets in Albemarle Sound and its Tributaries 23
    Dutch-nets in Pamlico and Albemarle Sounds 24
    Net-stakes Removed from Certain Waters 26
    Dutch-nets at the Inlets 27
    Laws of 1907, Chapter 948, An Act to Regulate Fishing in Pamlico and Other Rivers 27
    Power to Take Fish 28
    License to Fish 28
    License Tax 29
  New General Legislation Recommended 29
    Early Closing Season for Shad and Alewife or Herring 29
    Double Seining 30
    Protection of Sturgeon 30
    Rockfish 30
    Purse-net 30
    Shad and Herring 30
    Fishing on Sunday 31
    Pound-nets on East Side of Roanoke Island 31
    Closed Season for Fresh-water Fish 31
    Removal of Nets 31
    Fines 31
  Resolutions Relating to the Terrapin 31
    Diamond-back Terrapin Protected 31
  Resolutions Relating to the Oyster Industry 32
    Natural, Defined 32
    Oysters—Where Purchased to be Carried Out of the State 33
    Larceny of Oysters on Private Beds 33
    Oysters Caught at Night 33

PAGE
General Oyster Laws Recommended.................................. 34
    North Carolina Shell-fish Commission.......................... 35
    Inspectors, How Appointed..................................... 35
    Office and Clerical Force..................................... 36
    Equipment 36
    Duties of the Shell-fish Commissioner......................... 36
    Arrests Without Warrant....................................... 37
    Power to Take Oysters and Clams............................... 37
    Salaries 37
    No Interest in Oyster Fisheries............................... 37
    Revenue 37
Cultivation of the Oyster and Clam............................... 37
    Shell-fish Commissioner Can Lease Bottoms..................... 37
    Leasing of Bottoms.. 38
    Lease, How Obtained... 38
    Marking and Staking of Leased Bottoms......................... 39
    Term of Lease, Rental... 40
    Transfer of Lease... 40
    Re-leasing of Bottoms... 40
    Forfeiture of Lease... 41
    Title Secure 41
    Delivery of Oysters Without Inspection........................ 42
Special Resolutions Passed by Committee.......................... 42

Report of Fisheries Convention Held at Morehead City, North Carolina, August 26 and 27, 1908

Compiled by JOSEPH HYDE PRATT.

INTRODUCTION.

The convention called by Governor R. B. Glenn to investigate the condition of the fish and oyster industries of the State and to suggest legislation that would adequately protect and conserve these natural resources of the State and increase in value the fishing industries, convened at Morehead City on the morning of August 26, 1908. The delegates to this convention were appointed in the following manner: One delegate was appointed by the Governor and requested to call a meeting in his county to elect two other delegates to the convention. The following letter was sent out by His Excellency, Governor R. B. Glenn, to J. F. Tayloe, Washington, Beaufort County; Geo. Smithson, Coleraine, Bertie County; R. S. White, Elizabethtown, Bladen county; M. C. Guthrie, Southport, Brunswick County; T. B. Godfrey, Shiloh, Camden County; Charles Hill, Atlantic, Carteret County; T. H. Shepard, Edenton, Chowan County; Geo. N. Ives, Newbern, Craven County; W. L. Hawley, Fayetteville, Cumberland County; W. J. Tate, Kittyhawk, Currituck County; R. W. Smith, Manteo, Dare County; P. J. Cross, Gatesville, Gates County; B. F. Williams, Harrellsville, Hertford County; William Watson, Swanquarter, Hyde County; D. J. Fergus, Wilmington, New Hanover County; P L. Woodard, Pamlico, Pamlico County; W. W. Mann, Elizabeth City, Pasquotank County; J. F. Foy, Scotts Hill, Pender County; Ned Winslow, Hertford, Perquimans County; J. J. Laughinghouse, Greenville, Pitt County; Geo. L. Liverman, Columbia, Tyrrell County; W. H. Hampton, Plymouth, Washington County:

Sir.—In order to facilitate further investigations relating to the condition of the fish and oyster industries of North Carolina, I do hereby appoint you a delegate to a convention to be held the latter part of August or early in September, and I also request you to call a meeting of the fishermen of your county at as early a date as possible to elect two other members to this fish and oyster convention who, with you, will represent your county. At your county meeting, ascertain as clearly as possible the sentiments of your people regarding the protection of the fish and oyster industries and their ideas as to how the Fish and Oyster Commimssions can be made more effective.

This will be a most important convention and it is to the interest of the State and your county that it be represented. As soon as a meeting is held, notify me who have been elected as delegates. Unfortunately there is no way to reimburse the delegates for their expenses in attending this meeting.

Trusting to hear favorably from you regarding the above at an early date, I am,

Yours very truly,
R. B. Glenn,
Governor.

In response to this letter meetings were held in 19 counties of eastern North Carolina, and two other delegates elected who were then regularly appointed by the Governor.

REPORT OF MEETINGS.

The convention was called to order by Joseph Hyde Pratt, State Geologist, and the following counties responded to the roll-call: Beaufort, Bertie, Bladen, Brunswick, Carteret, Chowan, Currituck, Cumberland, Dare, Hyde, New Hanover, Pasquotank, Pender, Pitt, Tyrrell and Washington.

The temporary chairman was then elected permanent chairman, and W. J. Tate, of Kittyhawk, Currituck County, secretary.

The chairman discussed briefly the object of the convention and the line of work that it was desired to take up, speaking as follows:

"There is no doubt but that the supply of edible fish in the waters of North Carolina is becoming less and less each year. There are two facts which are responsible for this condition; first, insufficient laws for the protection of the fish; second, non-enforcement of the laws that have been passed.

"The falling off in the catch of fish is not due to the excessive use of any particular apparatus, but of over-fishing, and the permitting to fish apparatus in places where it ought not to be used. It is not due to the purse-netter, the pound-, seine-, or gill-netters, but to a combination of all, the State having permitted their use with little or no restriction. This privilege has been most outrageously abused and you fishermen know the result. With no adequate means of enforcing a law, it soon becomes a dead letter and many a fisherman is apt to catch fish in and out of season, of any size, with any kind of apparatus, because he thinks that if *he does not* some other fisherman will. In this way hundreds of thousands of small fish are caught which, if permitted to remain in the water, would in a year or two become valuable edible fish. The small fish caught in this way are often dumped on the shore, used as fertilizer, or shipped to market, with a faint hope that they may be marketable, but usually they are thrown out by the dealer.

"If the small fish are destroyed (by whatever means), it is a self-evident fact that there will soon be a scarcity of large ones and finally certain fish will become extinct in the waters of North Carolina. The size of the mesh ordinarily used by the pound-netters, and the seine-haulers has undoubtedly considerable to do with the destruction of small fish; but, whatever the reasons may be, it is obviously necessary that some means must be taken to obviate this condition and prevent the public from being deprived of such an important article of food, and the fishermen of an occupation.

"Not only is there a wholesale destruction of small fish, but the amount of apparatus fished in the State is considerably greater than the fisheries of the State can support. We have placed little or no restriction on the amount of apparatus that can be fished, and made hardly any attempt, except in a small territory, to enforce the laws that have been passed with a view to protect the fish.

"I am not putting it too strongly when I say that if the fishermen will not consult self-interest enough to protect the fishing industry of their own accord, they should be *made to do it.* Why? Because they are not the only ones interested in the fishes of North Carolina. Every man, woman and child in North Carolina has an interest in the fish of the State. They are vitally interested in the conservation of the fishing resources of the State. Every one of them as a citizen of North Carolina has a perfect and constitutional right to fish in any of the waters belonging to the State, to come to eastern North Carolina for a certain part of the year and make a business of fishing, taking their profits back with them to central and western North Carolina.

"The protection of the fish and the fostering of our fishing interests are not county questions but State questions; they are not questions of interest only to the individual but to the whole people; and, in passing laws to protect and foster our fishing industries, we must consider the State before the county and the whole people before the individual.

"I believe that the only adequate method of enforcing our fish laws and fostering our fishing industries is through a Fish Commission. A Commission that will not only see that the laws are enforced (and if there is a bad law, its enforcement will very quickly cause it to be repealed, and every law until it is repealed should be enforced), but also be able to carry on investigations relating to the various fishing industries; to study local conditions and be able to render a just decision regarding what is the best thing to be done for the best interests of the State.

"At every legislature there are introduced many bills relating to fishing in eastern North Carolina, nearly all of which are local in the benefits that are supposed will be derived by their passage, and have been drawn up regardless of the hardships or the injustice they may work on other sections of the same county or other counties; and no thought is given as to how it will affect the interests of the State.

"Two of the main questions that should receive the serious consideration of the convention are: The value of the Fish Commission to the State as a whole; and the necessity of passing adequate laws which will permit of the cultivation of oysters in the waters of North Carolina. Another question that we must consider is the protection of game fish in the mountain streams of the western part of the State and in this connection it would be well to take up the advisability of bringing under the jurisdiction of the Audubon Society the protection of the game fish in this section. We have with us as a delegate to the convention Mr. T. Gilbert Pearson, Secretary of the Audubon Society, who will later discuss this phase of the work."

The first question taken up for discussion was the value of the work of the Fish Commission to the State and regarding the extension of its jurisdiction. It was nearly unanimously acknowledged that the Fish Commission had been a benefit to the fishing industries in those counties under its jurisdiction and that it would be for the best interests of the State to have all the counties in eastern North Carolina in which commercial fishing is carried on come under the jurisdiction of the Fish Commission; but the convention was also of the opinion that it should not recommend that all the counties be forced to come under the jurisdiction of the Fish Commission.

Mr. T. Gilbert Pearson, Secretary of the State Audubon Society, addressed the convention at the afternoon meeting, August 26th, and stated in some detail the necessity of protecting our natural resources and showed how, with unrestrained hunting and fishing, the supply of birds and fish would grow scarcer and scarcer. Nature has made allowance for the destruction of a certain number of all kinds of animals by their natural enemies in the animal world, but when man steps in he creates an artificial condition with which nature finds it difficult or impossible to cope. We have two questions in connection with the conservation of these resources; first, to preserve what is here and second, to propagate. Each of these is as important as the other. Mr. Pearson stated that about 20 years ago there was something like $11,000 spent in this country in the protection of game birds and fishes, while at the present time there are over $2,000,000 spent annually. He showed how it is impossible to protect the fish either on the coast of North Carolina or in the mountain streams without an adequate amount of money to carry on the work. In discussing the subject of the protection of game fishes in central and western North Carolina, Mr. Pearson stated that many persons interested in these had asked if the laws could not be amended in such a way that the wardens, acting under the Audubon Society, would have the enforcement of the laws relating to game fish in the western part of the State. Mr. Pearson was of the opinion that the State Audubon Society would gladly undertake this work of protecting the game fish in connection with their work of protecting the game birds.

A motion was, therefore, made and passed by the convention that it would be to the best interests of the Fish Commission and that the game fish could be better protected if this protection of the game fish in the middle and western counties should be brought under the jurisdiction of the State Audubon Society, provided the people of the central and western portions of the State desired it.

Resolutions Presented.

The following resolutions were presented to the convention by the delegates from their respective counties.

BEAUFORT COUNTY.

Resolved, That the fishermen of Beaufort County are in favor of a closed season from the 20th of April to the 1st of June for the protection especially of shad and herring during their spawning season, and that all pound-nets, drag-nets of whatever description shall be taken out of the waters of Beaufort County during that period.

CUMBERLAND COUNTY.

Resolutions presented by Charles D. Jones.

Whereas, At Fayetteville, Cumberland County, N. C., the fishing for shad is done with bow-nets and during the fishing season freshets prevail about one-half the time, so that there is sufficient depth of water to enable an abundant supply of shad and other fish to pass to the spawning grounds; and,

Whereas, At Prospect Hall and at the Inlet at the mouth of the Cape Fear River, certain forms of fishing are being carried on which are detrimental to the interests of the general fishing industry; and,

Whereas, Special agents sent out by the U. S. Bureau of Fisheries have reported that these conditions are injurious to the fishing industries, *Be it Resolved,* By the Fishermen of Cumberland County, that they request the Fish and Oyster Convention held at Morehead City, at the call of Governor R. B. Glenn, to consider these conditions to recommend such legislation as will protect the interests of both fishermen and consumer, and prevent the destructive and ruinous methods of fishing as mentioned above.

CURRITUCK COUNTY.

Resolutions presented by W. J. Tate.

WHEREAS, The fishing industry of Currituck County is practically confined to black bass, and as they are not a migratory fish, but are spawned and reared naturally in Currituck Sound; and,

WHEREAS, Currituck Sound produces from one-half to three-fourths of the total yield of the State; and,

WHEREAS, Currituck County has for years and is now jealously protecting this industry by local laws passed by our representatives, said laws making an early closing season sufficient for breeding purposes;

In view of the foregoing, we, your Committee, fail to see any benefits to be derived by our County in placing ourselves under the administration of the Fish Commission. We consider it unjust and a hardship upon us to be taxed to protect an industry that we are already giving intelligent protection. And we suggest that this meeting instruct our delegates to the Fish and Oyster Convention at Morehead City to use their best efforts to prevent Currituck County from coming under the administration of the Fish Commission.

DARE COUNTY.

Resolved, That the fishermen of Dare County be permitted to fish a distance of 4,000 yards from Long Shoal Point at right angles to a line running along the shoal, the nets to extend toward the west.

NEW HANOVER COUNTY.

Petition presented by Geo. H. Smith.

We, the undersigned, appointed delegates of New Hanover County, desire to place before this honorable body a few things that we consider of very great importance to our section.

ARTICLE 1. That the fishermen of our county may be allowed to fish one and one-eighth bar and upwards, but nothing less, upon the grounds that our waters are not used for breeding purposes. The depth of our fishing waters is from five to ten feet, and it is a well-established fact that such water depth is not used for breeding purposes at any time.

Art. 2. That there be a commissioner appointed to see that such laws shall be enforced in New Hanover County.

Art. 3. That each and every fisherman owning or fishing with net or seine in these waters shall be taxed a small amount to defray the said expense.

PAMLICO COUNTY.

The following petition, signed by over 200 citizens of Pamlico County, and addressed to His Excellency, Governor R. B. Glenn, was presented to the convention:

"We, the undersigned citizens of Pamlico County, respectfully ask you to take some steps to protect us against the taking up by entry of our natural oyster bottoms. Several entries have been made and grants secured for such oyster bottom as has been heretofore affording a support for many of our citizens during the oyster season. If it lies in your power, we would further ask you to annul these grants that have been issued for said bottom and give back to us our natural oyster grounds."

The report of the Fish Commissioner, Mr. Theo. S. Meekins, was submitted and read.

Report of Fish Commissioner.

Manteo, N. C., August 14, 1908.

Members of the Convention:

Having been requested by Mr. Joseph Hyde Pratt, State Geologist, to present my views as to the present laws regulating fishing and to offer such changes and recommendations as my judgment dictates, I beg leave to submit the following:

In the first place, I shall endeavor to discuss such laws as are of a general nature, disregarding the great number of private and local measures which time and space now forbids, and deal with those affecting the greater number interested in the fish industry.

In my January report to the Geological and Economic Survey Board, I recommended the codification of the fishing laws for North Carolina. My reason for doing this was due to the vast number of Acts upon the statute books dealing with almost every locality where fishing is carried on to such an extent that it is almost impossible to ascertain what the law is, as applied generally, as each succeeding Legislature has been inclined to restrict the fishing industry, having as its object the promotion of the industry, thereby adding statute upon statute so that to-day one not versed in the law can make only a feeble attempt to state or execute the law. This work of codification has been granted by the Board and in a short time will be ready for distribution.

Under the head of changes and recommendations, I respectfully submit the following:

First. That Section 2424 of the Revisal of 1905 be repealed for the reason that Section 2440 of the Revisal of 1905 makes the necessary restrictions.

Second. That Section 2428 of the Revisal of 1905 be repealed because Section 2429 of the Revisal of 1905 includes the former and makes the necessary restrictions, except the penalty, which should be added to Section 2429, and to this I recommend the following changes: That all after the word "year" in line 16 be repealed and in lieu thereof the following be inserted:

"That any person violating the provisions of this section shall be guilty of a misdemeanor and shall be fined not less than fifty dollars nor more than one hundred dollars in the discretion of the Court."

Third. That Section 2432 of the Revisal of 1905 be amended by omitting the word "authorized" in line four and inserting in lieu thereof the word "directed."

Fourth. That Section 2433 of the Revisal of 1905 be repealed. I make this recommendation because it is not practical and to enforce said section would stop all pound- and gill-net fishing within the limits named; in fact, would eliminate all fishing for commercial purposes within the boundaries named in said section.

Fifth. Section 2440 of the Revisal of 1905, commonly known as the Vann Bill, is in my opinion, after having one year's experience as Fish Commissioner, almost all the law necessary for such territory as it covers. With slight modifications, it is a wise law and one of vast importance to the fishing industry of the State. The survey made last winter was almost all the marking of the territory under this section.

In my opinion, this section should be changed so as to make the ten-mile S. E. line from Big Island, read five miles S. E. by E. one-eighth E. from Roanoke Marshes Light House, as recommended by Mr. W. F. Hill. I also recommend that one thousand yards be allowed around Hog Island Marsh instead of five hundred yards.

I respectfully call your attention to the situation on either side of Roanoke Marshes, and recommend that straight lines be run from the stake 2000 yards from the shore in the two and one-half mile radius from Roanoke Marshes Light House to 500 yards eastward from the point of Roanoke Marshes, and that straight lines be run from the stake one-fifth the width of Croatan Sound in the two and one-half radius from Roanoke

Marshes Light House south to the stake 500 yards from the eastward point of Roanoke Marshes. I also recommend that the provisions of this section, *so far as applies to pound-nets in Albemarle and Croatan sounds,* apply to the entire year instead of from January 15 to May 15 of each year.

The following is a copy of the report made by Mr. W. F. Hill; also a chart of the survey made under the directions of the Commission.

REPORT OF THE SURVEY OF NORTH CAROLINA FISHERIES, REFERRING TO DUTCH- OR POUND-NET FISHING IN ALBEMARLE, CROATAN AND PAMLICO SOUNDS, NORTH CAROLINA.

April 15, 1908.

The Commissioner, Bureau of Fisheries, Washington, D. C.:

Sir.—In consequence of a communication from the State Geologist of North Carolina, an extract from which follows:

"*Hon. Geo. M. Bowers, Commissioner, Bureau of Fisheries,*
Washington, D. C.:

Sir.—Regarding the assistance that I wish in connection with marking the boundaries, it is similar to that you did for us three years ago when Mr. Hill was detailed. We desire this time to have the boundary surveyed through Albemarle Sound and Chowan River, as well as Croatan Sound and the eastern part of Pamlico, as the territory represents that portion that comes under the control of the Fish Commissioner. If Mr. Hill could be detailed for the work, it would be of very great assistance to us.

I am writing to-day to Mr. Theodore S. Meekins, our Fish Commissioner, at Manteo, N. C., asking him to arrange for the boat with which to carry on the work and I will ask you to notify him if Mr. Hill can be detailed for the work and at what time.

Yours very truly,
(Signed) JOSEPH HYDE PRATT,
State Geologist."

I received your order No. 127, dated November 11, 1907, in pursuance of which preparations were made to carry out the survey as outlined in the request of the State Geologist of North Carolina.

The Coast and Geodetic Survey, responding to a request from the Bureau of Fisheries, supplied the necessary charts, description of triangulation stations and other data. By correspondence with the Fish Commissioner of North Carolina, the date and place for beginning the survey were fixed, viz., December 3, 1907, Edenton, N. C. Accordingly, I left Washington, D. C., the afternoon of December 2, 1907, and arrived in Edenton the afternoon of December 2, 1907. Several hours of December 2 were spent at the United States Engineer's Office in Norfolk, Va., searching for additional data for the Chowan River, which was thought might assist in the survey.

On December 3, 1907, the Fish Commissioner of North Carolina met me at Edenton with a gasoline launch chartered for the work. The survey began practically on the 3d of December, 1907, covering the area from Holiday's Island, Chowan River to Hatteras Inlet, Pamlico Sound. The distance traversed, including both sides of Chowan River, of Albemarle Sound, of the northeast portion of Pamlico Sound, and the west side of Croatan Sound, was in round numbers, two hundred and forty miles, and distributed along this distance are 59 stakes, indicating the fishing area bounds.

The time limit designated for the accomplishment of this work was originally set at two months; but, owing to much unsuitable weather that delayed the work, this time limit was later extended.

A set of coast-survey charts, similar to the charts used and on which the survey was platted, was also made for the Fish Commissioner of North Carolina.

To the United States Coast and Geodetic Survey, for its courtesy in supplying charts and other necessary assistance, cordial thanks are extended.

Your attention is respectfully invited to the following remarks and recommendations.

Respectfully,
(Signed) W. T. HILL,*
Draftsman.

As is to be observed, the shore line is very irregular; consequently to have parallelled the shore line would have indefinitely protracted the time of the survey. The Fish Commissioner of North Carolina, therefore, decided to make the boundary (by stakes) only at the salient points and allow (verbal instructions to fisherman) the fisherman in the " bays " to extend their " set " out on the line between the stakes on either side of their " set." This adjustment apparently produced general satisfaction, with only two or three exceptions.

No boundary stakes were placed between the Alligator and Scuppernong Rivers on south side of Albemarle Sound, nor on the north side, from Pasquotank River to Roanoke Sound, as very little if any pound-net fishing is carried on in these localities, the probable cause of this, referring to the shore between the Alligator and Scuppernong Rivers, being such a long stretch of beach, with no harbors near, subjecting the fisherman consequently to danger from the northerly winds which prevail during the fishing season.

The method of locating the boundary was as follows:

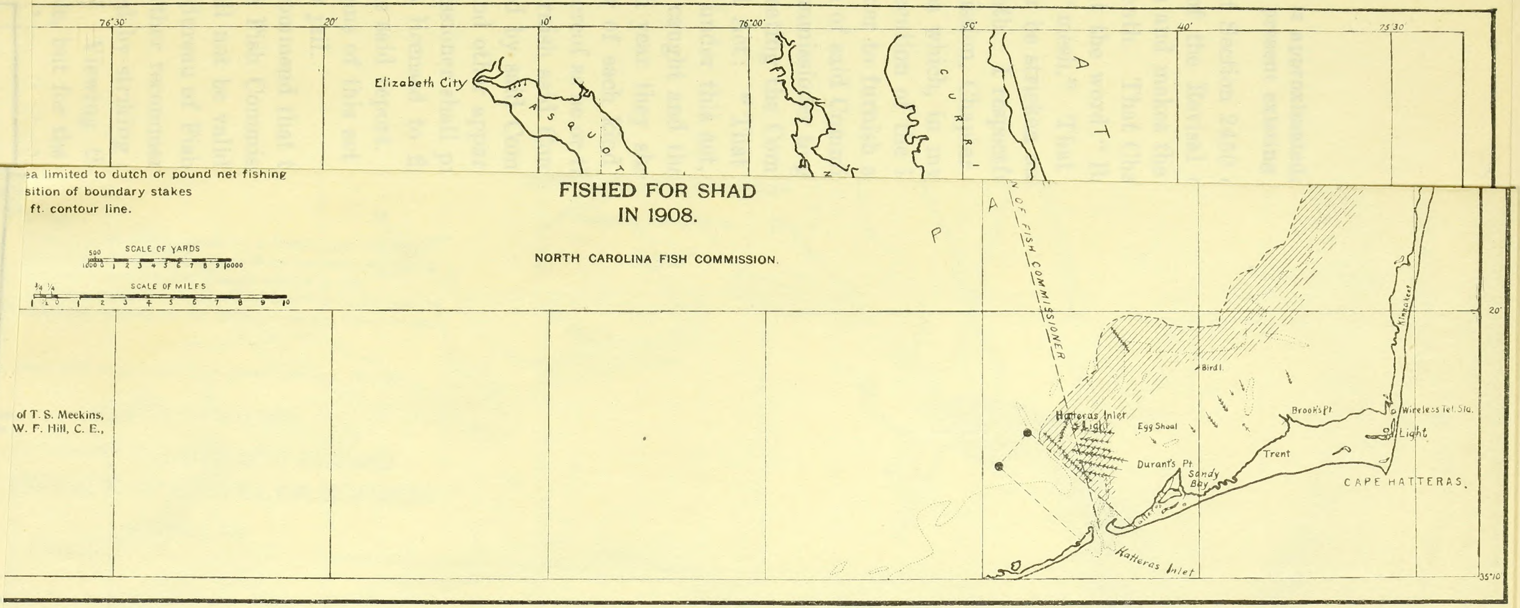
A base line parallel with, and range at right angles to, the point of shore off which the boundary stake was to be placed, was led out by the compass (prismatic pocket) bearings, and measured; flag poles set at each end of the base line and on range. The distance from shore being known, and the direction being given by range, a right-angled triangle was presented for solution, which has the two sides, base and altitude, given, and the angle subtending the base at the distance off-shore, computed. This angle was set on the sextant and the boat run out on the range until the conditions above were satisfied, when the stake was placed.

This method was resorted to because it was found to be expedient and that a very close approximation to accuracy could be obtained. To have hunted up the Coast Survey triangulation stations, especially in the Albemarle Sound region, would have involved so much time and expense in the erection of the signals, etc., that it was abandoned at the outset as impractical for the subject in view.

It is therefore to be noted that the geographical position of the boundary

---

* Remarks by W. T. Hill referred to the survey and methods adopted in the execution thereof, see accompanying chart.



FISHED FOR SHAD
IN 1908.

NORTH CAROLINA FISH COMMISSION.

ea limited to dutch or pound net fishing
sition of boundary stakes
ft. contour line.

of T. S. Meekins,
W. F. Hill, C. E.,

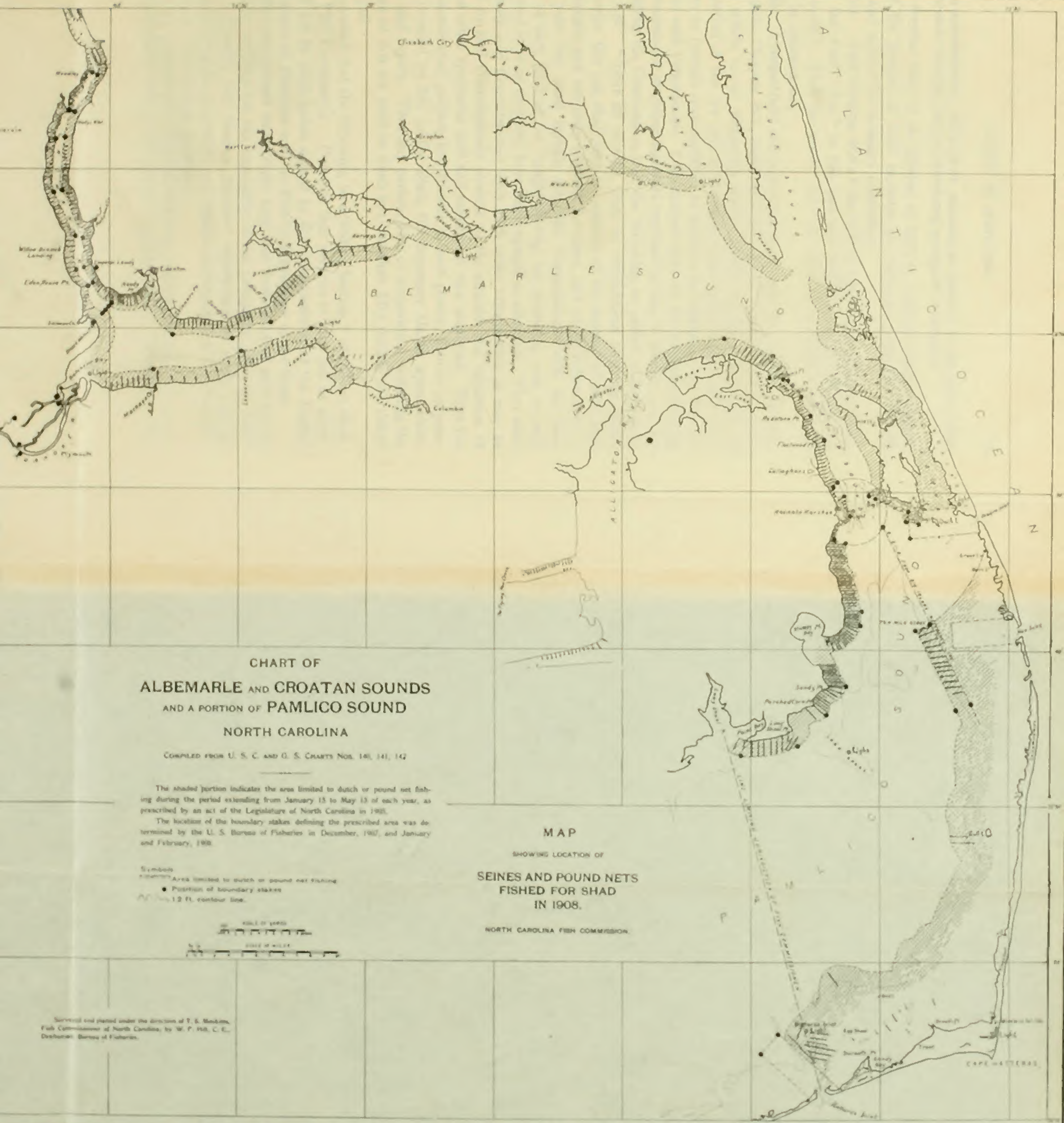


CHART OF
ALBEMARLE AND CROATAN SOUNDS
AND A PORTION OF PAMLICO SOUND
NORTH CAROLINA

COMPILED FROM U. S. C. AND G. S. CHARTS NOS. 140, 141, 142

The shaded portion indicates the area limited to dutch or pound net fishing during the period extending from January 15 to May 15 of each year, as prescribed by an act of the Legislature of North Carolina in 1905.

The location of the boundary stakes defining the prescribed area was determined by the U. S. Bureau of Fisheries in December, 1907, and January and February, 1908.

Symbols
▨ Area limited to dutch or pound net fishing
● Position of boundary stakes
12 ft. contour line.

MAP
SHOWING LOCATION OF
SEINES AND POUND NETS
FISHED FOR SHAD
IN 1908.

NORTH CAROLINA FISH COMMISSION.

Surveyed and platted under the direction of T. S. Meekins, Fish Commissioner of North Carolina, by W. P. Hill, C. E., Draftsman, Bureau of Fisheries.

stakes is approximated; while their positions as referred to the actual shore line at present existing may be considered accurately determined.

That Section 2450 of the Revisal of 1905 be repealed because Section 2440 of the Revisal of 1905 includes the territory mentioned in this section and makes the necessary restriction.

Seventh. That Chapter 948 of the Acts of 1907 be amended by striking out the word "Bar" in line two and inserting in lieu thereof the word "mesh." That the word "bar" in line three, Section 2, of said chapter be stricken out.

Eighth. I respectfully call your attention to the act creating the Fish Commission, Chapter 977, Acts 1907, and beg to mention the following changes which, in my judgment, would greatly aid the Commission in the execution of the law and at the same time would enable said Commissioner to furnish such statistics as seems to be necessary for the promotion of said Commission. I recommend that for the purpose of aiding the Commissioner to gather statistics required by him in Section 5 of the Act creating the Commission that the following be added to Section 11 of said Act: "That all persons, firms or corporations securing license to fish under this act, shall keep an account of the number of each kind of fish caught and the price received for same, and on or before July 1, of each year they shall furnish the Fish Commissioner with the total number of each kind of fish caught during the preceding year or such part thereof as he or they may have been engaged as aforesaid. They shall also furnish said Commissioner with such other information as may be required by said Commissioner relative to the number and valuation of boats and other apparatus used and number of men employed. That the Commissioner shall prepare and furnish to each person, firm or corporation so licensed to fish in the State the necessary blanks upon which to make said report. That any person, firm or corporation violating the provisions of this act shall be fined not less than fifty dollars nor thirty days in jail.

I recommend that the following be added to Section 7 of the act creating the Fish Commission: *Provided* that permits to take fish as aforesaid will not be valid unless signed by the Commissioner of the United States Bureau of Fisheries and the Fish Commissioner of the State.

I further recommend and strictly urge that Section 14 of said Act be amended by striking out the remainder of the paragraph after the word "each." Viewing this from a financial standpoint, it would not be advisable, but for the promotion and future development of the Commission, I deem it absolutely necessary.

Ninth. I recommend that the following restrictions be made as to fishing pound-nets on the east side of Roanoke Island. "It shall be unlawful to fish with dutch-, pod-, fyke-, or other pound-nets, or nets of like kind, in the waters east of Roanoke Island, and within the following boundaries, viz.: north, from the north line, five miles long, west of Oregon Inlet, mentioned in Section 2440 of the Revisal of 1905 to Mill Creek, except such as shall be fished not to exceed one thousand yards from the eastern shore of Roanoke Island.

The total receipts derived from taxes during the first year of the Commission, from June 1, 1907 to June 1, 1908, is as follows:

Dare County	$1,597.46
Washington County	187.10
Pasquotank County	45.82
Tyrrell County	174.05
Perquimans County	334.28
Chowan County	897.14
Bertie County	335.20
Sampson County	6.70
Total	$3,577.75

The expenditures for the year were as follows:

Travelling expenses for Commissioner	$109.82
Travelling expenses for Deputy Commissioner	44.60
Office rent	99.97
Stationery	11.90
Office furniture and fixtures	89.47
Attorney's fee	10.00
Postage	48.57
Clerk hire	19.25
Inspectors	151.61
Patrol boats, men and expenses of same	824.09
Salary of Commissioner and Dept.-Com	1,333.33
Survey	718.83
Total	$3,461.44

During the first year the following number and kinds of nets have been licensed:

County.	Pound-Nets.	Fyke.	Drag-Nets and Seines, yds. of.	Anchor Gill-Nets. yds. of.	Stake Gill-Nets, yds. of.
Dare	1,254	..	1,530	18,700	320,040
Washington	171	20	..	5,402	5,454
Pasquotank	45	60	..	..	20,245
Tyrrell	100	71	..	2,000	53,890
Perquimans	225	5	..	25,200	43,975
Chowan	908	..	..	5,000	20,200
Bertie	251	11	5,280	..	4,700
Sampson	1	4	100	..	1,900
Total	2,955	171	5,910	56,302	479,434

I respectfully call your attention to that part of Section 5 of the Act creating the Commission which requires surveys of the waters where the use of fishing is prohibited and recommend that in making such surveys under said act, the law should designate the distance between stakes or buoys and provide that straight lines be run from stake to stake or buoy to buoy, thereby giving equal opportunity or advantage to all setting between said points.

Finally, I recommend that a law be enacted empowering the Commissioner and his Deputies to remove all nets set in violation of the law, at the expense of the violator, and that all laws in conflict with the above be repealed.

Respectfully,
(Signed) THEO. S. MEEKINS,
Fish Commissioner.

The resolutions adopted by the committee that was appointed by Governor R. B. Glenn, in 1906, to investigate the fishing industries of the State were also presented to the Convention.

All the resolutions presented to the convention and the reports of Mr. Meekins, Fish Commissioner, and Mr. Hill, of the U. S. Bureau of Fisheries, were carefully reviewed and considered by the convention.

RESOLUTIONS ADOPTED BY CONVENTION.

The opinion of the convention regarding what legislation is necessary for the best interests of the fish and oyster industries is expressed in the following resolutions, which refer, first, to the sections of the Code as given in the Revisal of 1905; then to the sections as given in the Public Laws of 1907; and finally, to entirely new legislation.

Resolved, That section

2429. DUTCH-NETS IN PAMLICO RIVER.—It shall be lawful to fish with dutch-, pod-, pyke-, or other pound-nets, or nets of like kind, in the waters of Pamlico River below a line beginning on the southern shore of Pamlico River at Maule's Point, and running due north to a point on the northern shore of said river: *Provided,* that no dutch-, pod-, pyke,- or pound-net, or other nets of like kind, shall extend out in said river more than one-eighth of the distance across said river from the shore, and that none of said dutch-, pod-, pyke-, or pound-nets shall be set, placed down, or fished nearer to each other than five hundred yards, measuring up and down the river; nor shall they be placed, set down, or fished within five hundred yards of any seine-beach in actual use for hauling a seine, nor within one mile of the mouth of Bath Creek: *Provided,* no nets of the kind enumerated in this section, or other nets of like kind, shall be placed down, set, or fished in said rivers between the tenth day of May and the first day of July in any year. Whenever any person shall complain to the Oyster Commissioner or any inspector that dutch-, pod-, or pyke-nets, or other nets of like kind, have been placed down or set in any of the waters of Pamlico River, or in any of its tributaries, contrary to and in violation of this section, said Oyster Commissioner or inspector, or person performing the duties of such, shall at once visit said river, make a complete and full examination of all dutch-, pod-, or pyke-nets, or other nets of like kinds, in said river, and ascertain whether they are placed down, set, or fished in violation of the provisions of this section, and he shall report to the Solicitor of the district in which the offense is committed.

Code, s. 3417; 1903, c. 52.

be amended so that the words " Oyster Commissioner " shall in each case read " Fish Commissioner " and that all after the word " year " in line 14 (line 16 as printed in the Revisal of 1905) be repealed and the following be inserted in lieu thereof: That any person violating the provisions of this section shall be guilty of a misdemeanor and shall be fined not less than $50 nor more than $100 in the discretion of the court.

That section

2432. Game Warden's Right to Search Vessels.—If any constable, game warden or justice of the peace of Currituck County shall be informed, or have cause to suspect, that either of the two preceding sections are being violated, he is hereby authorized and empowered to examine the contents of any fishing-boat, or packages in transit, and any person or common carrier refusing to exhibit the contents of any fishing-boat or package to such officer shall be guilty of a misdemeanor, and shall be fined not less than twenty-five and not more than fifty dollars.

1905, c. 273, ss. 2, 7.

be amended by omitting the word " authorized " in line four and inserting in lieu thereof the word " directed."

That section

2345. Dutch-nets in Carteret County.—If any person shall use or cause to be used any dutch-net, pound-net, or other stationary trap, net, or seine of similar description, by whatever name known, in the waters of Carteret County for the purpose of taking fish therefrom, he shall for each day's use thereof forfeit and pay the sum of fifty dollars. The penalties herein created shall be recovered by a warrant before any justice of the peace in the county of Carteret, and shall be applied to the use of the public schools of said county; and such offender, in addition to the penalties contained in this section, shall be guilty of a misdemeanor and fined not less than one hundred dollars nor more than five hundred dollars, or imprisoned in the county jail not less than six months nor more than twelve months: *Provided*, this section shall not apply to the ordinary set-nets heretofore in use in the waters of said county.

Code, s. 3420; 1883, c. 199.

be amended so as to read, " If any person shall use or cause to be used any dutch-net, pound-net, or other stationary trap, net, or seine of similar description, by whatever name known, in the waters of Carteret

County for the purpose of taking fish therefrom, he shall for each day's use thereof forfeit and pay the sum of fifty dollars, excepting from Point of Marsh on south side of Neuse River and running westwardly to Adam's Creek and extending out to a distance of one thousand yards from the shore: *Provided,* that in no case shall the distance the nets extend out into the water be greater than one-eighth of the width of the river: *Provided further,* that the nets shall be one-half mile apart The penalties herein created . . . . " to read the same as original section, except that " applied to the use of the public school fund of said county " shall be changed to read, " applied to Fish Commission fund."

That section

2439. DUTCH-NETS IN ALBEMARLE SOUND AND ITS TRIBUTARIES.—No person shall set or fish any dutch-net or pound-net in Roanoke River, Cashie or Middle and Eastmost rivers, or within two miles of the mouth of said rivers, or within one mile of the mouth of any other river emptying into Albemarle Sound, of less than two miles in width at its mouth, and any such net set within one mile of the mouth of any other river emptying into said sound shall not extend into the main channel at its mouth. No person shall set or fish with a dutch-net or pod-net within half a mile to the eastward or westward of the outside windlasses or snatch-blocks of any seine-fishery in operation on said sound; and any such net set or fished within one mile of such windlasses or snatch-blocks of any seine-fishery in operation shall run in a due north and south course from the shore, and shall not extend further into the sound from the water's edge than the distance from such windlass or snatch-blocks to the line of such net; and all persons who shall set or fish any such net in said sound shall pull up and remove the stakes used for the same by the first day of June next succeeding the fishing season, and if any person shall set or fish any dutch-net or pod-net in said sound in violation of this section, he shall be guilty of a misdemeanor, and be subject to a penalty of three hundred dollars, to be recovered by any person in the Superior Court of the county in which the offense shall be committed. And the Sheriff of such county shall, when requested, remove any portion of such nets set or fished in violation of this section at the cost of the violator: *Provided,* that dutch-nets may be used in Cashie River two and one-half miles from its mouth, if they do not extend more than one-third the width of said river from the shore, and such nets may be along the sound shore on the Bertie County side between the following points along said shore, to-wit: commencing at the mouth of Cherry Tree Cut branch, Kentrock field and Landing field, and running around the shore to the mouth of Morgan swamp, thence to Rock Spring branch, and that any nets set or fished within that line shall not extend from the shore in any direction a greater distance than four hundred and fifty yards measured at high water, and within this distance of four hundred and fifty yards is to be included the nets, hedges and all parts thereof.

Code, s. 3383; 1889, c. 122; 1891, c. 322; 1895, c. 245; 1899, c. 310; 1899, c. 412.

be amended as follows: In line 11 (line 13 of the Revisal of 1905) leave out the words "in a due north and south course" and substitute for this; "at right angles to the shore"; in line 15 (line 17 of the Revisal of 1905) leave out the words "remove the stakes used for the same by the first of June next succeeding the fishing season" and insert in lieu thereof; "remove all broken, decayed and abandoned stakes by the first day of May of each year"; and leave out beginning in line 18 (line 21 of the Revisal of 1905) "to be recovered" and ending with "of the violator," line 21 (line 25 of the Revisal of 1905).

That section

2440. DUTCH-NETS IN PAMLICO AND ALBEMARLE SOUNDS.—If any person shall set or fish any net, seine, or appliance of any kind for catching fish at any place within a radius of two and one-half miles either way from Roanoke Marshes lighthouse at a distance more than five hundred yards from the shore of Roanoke Island or the mainland on the western side of Croatan and Pamlico sounds; or shall set or fish any pound- or dutch-net on the eastern side of Pamlico Sound within ten miles of the Roanoke Marshes lighthouse, except such as shall be fished within five hundred yards of the Roanoke Island or Hog Island shores; or shall set or fish any dutch- or pound-net on the eastern side of Pamlico Sound more than two thousand yards west of a line running south-southeast from Big Island to Bulkhead or shoal west of Chicamacomico or south of said point more than two thousand yards from the shoals as marked on the United States Government chart made from data obtained to November twenty-second, one thousand nine hundred and four; or shall set or fish any dutch- or pound-net on the west side of Pamlico Sound in said sound extending into the water more than two thousand yards from the shore of the mainland; or shall set or fish any pound- or dutch-net in Croatan Sound further from the shore than one-fifth the width of said sound at that point; or shall set or fish any pound- or dutch-net in the Albemarle Sound more than two thousand yards from the shore of the mainland, or in Chowan River further from shore than one-third the width of said river at place where said nets are fished or set, or within one-fourth mile of any wharf used by a steamer on said river; or shall set or fish any net or appliance of any kind for catching fish within one mile on north or south side of a line five miles long running west from center of New Inlet or Oregon Inlet, or on north or south side of a line five miles long running northwest from center of Hatteras Inlet, he shall be guilty of a misdemeanor and be fined or imprisoned, in the discretion of the Court. The provisions of this section shall apply only to that part of each year beginning January fifteenth and ending May fifteenth. The place of trial for offenses under this section shall be the county opposite where the act was committed. It shall be the duty of the Oyster Commissioner or Assistant Oyster Commissioner, whenever an affidavit is delivered to him stating that the affiant is informed and believes that this section is being violated at any particular place, to go himself or send a deputy to such place, investigate same, and he shall seize and remove all nets or other appliances setting or being used in violation of this section, sell same at public auction and apply proceeds of sale to payment of cost and expenses of such removal, and pay any balance remaining to the school fund of county nearest to where offense is committed. 1905, c. 292.

be amended so as to read as follows:

DUTCH- AND OTHER-NETS IN PAMLICO AND ALBEMARLE SOUNDS AND CONTIGUOUS WATERS.—If any person shall set or fish any net, seine or appliance of any kind for catching fish at any place within a radius of two and one-half miles either way from Roanoke Marshes lighthouse at a distance more than five hundred yards from the shore of Roanoke Island or the mainland on the western side of Croatan and Pamlico sounds, *except that on the western side of Pamlico and Croatan sounds fishing shall be permitted in that territory extending one thousand yards from the shore beginning at the two and one-half mile limit heretofore defined and extending to the southern end of the Roanoke Marshes on the Pamlico Sound side and to the north end of the same marshes on the Croatan side, but in neither case shall the nets within this one-thousand-yard limit be within one and one-quarter miles in any direction from the Roanoke Marshes lighthouse;* or shall set or fish any pound- or dutch-net on the eastern side of Pamlico Sound within ten miles of the Roanoke Marshes lighthouse, except such as shall be fished within *one thosusand* yards of the Roanoke Island or Hog Island shores; or shall set or fish any dutch- or pound-net on the eastern side of Pamlico Sound more than two thousand yards west of a line running south-southeast (*magnetic*) from Big Island *to a point on the twelve-foot curve westerly* of Chicamacomico, or south of said point more than two thousand yards from *the twelve-foot curve* as marked on the *chart of the Coast and Geodetic Survey corrected* from data obtained to November 22, 1904; or shall set or fish any dutch- or pound-net on the west side of Pamlico Sound in said sound extending into the water more than two thousand yards from the shore of the mainland; or shall set or fish any pound- or dutch-net in Croatan Sound further from the shore than one-fifth of the width of said sound at that point; or shall set or fish any net, seine, or appliance of any kind for catching fish at any place within the area of one-fifth the width of the sound or river on either side of a line passing through *the middle* of the channel of Croatan Sound and *the middle* of Albemarle sounds up Chowan River and other tributaries of Albemarle Sound; or shall set or fish any pound- or dutch-net in the Albemarle Sound more than two thousand yards from the shore of the mainland or in Chowan River further from the shore than one-fourth of the width of said river at the place where said nets are fished or set or within one-fourth mile of any wharf used by a steamer on said river; or shall set or fish any net or appliance of any kind for catching fish within one mile on either side of a line running *westerly or southwesterly from the center of New Inlet to an intersection with the line extending from Big Island southeast (magnetic) or within one mile on either side of a line running westerly or southwesterly from the center of Oregon Inlet to a point two thousand yards west of the continuation of the said line running from Big Island south-southeast (magnetic) or within one mile on either side of a line six miles long running from the center of Hatteras Inlet through and beyond Hatteras Inlet lighthouse, these restricted areas to include the channels extending from Oregon, New, and Hatteras inlets respectively,* he shall be guilty of a misdemeanor and be fined not less than fifty (50) dollars or imprisoned not less than thirty days, in the discretion of the Court. The provisions of this section shall apply only to that part of each year in which *shad and herring fishing are permitted by law in the several waters;* except that in Albemarle and Croatan sounds the provisions of this section shall apply for the entire year as far as it relates to pound-nets. The Fish Commissioner is authorized in determining the boundaries of the restricted areas on either side of Roanoke Marshes to run straight lines from the stake two thousand yards from the shore in the two and one-half-mile radius from Roanoke Marshes lighthouse to the 500-yard stake eastward from the point of Roanoke Marshes, and shall run straight lines from the stake one-fifth the width of Croatan Sound in the two and one-half-mile radius from Roanoke Marshes lighthouse south to the stake 500 yards from the eastward point of Roanoke Marshes; that the boundary lines marking the restricted areas in these sounds shall be run in straight lines from stake to stake located at certain points, but said stakes not to be in any case more than three miles apart. The place of trial for offenses under this section shall be the county opposite where the act was committed.

That section

2448. NET-STAKES REMOVED FROM CERTAIN WATERS.—Every person who shall set or use any net in the waters of Pamlico, Croatan, Currituck, or Albemarle sounds, or their tributaries, except Perquimans River, shall be required to pull up and remove their net-stakes within thirty days from the day the nets were taken from them, and not later than the first day of June, and any person failing to pull up and remove their stakes, as required by this section, shall be guilty of a misdemeanor, and fined not more than fifty dollars or imprisoned not more than thirty days.

Code, ss. 3382, 3414; 1883, c. 69; R. C., c. 81, s. 8; 1844, c. 40, s. 7; 1852, c. 13; 1893, c. 147.

be amended as follows; "and remove their net-stakes within thirty days from the day the nets were taken from them, and not later than the first day of June," to read "and remove all broken, decayed, and abandoned stakes by the first day of May of each year."

That section

2450. Dutch-nets at the Inlets.—If any person shall set any pound-net, dutch-net, or hedge-net within two miles of Oregon Inlet or Hatteras Inlet or within ten miles of New Inlet in Dare County, North Carolina, or shall between the first day of January and the first day of May following of any year, set or operate any seine or stationary nets of any kind in the main channels within three miles of the inside mouths of Ocracoke, Hatteras, Oregon, or any other inlet north of Ocracoke Inlet, connecting the waters of the Atlantic Ocean with any of the sounds or other inland waters of North Carolina, or shall fish with seines or nets of any description in the waters of Bear Inlet or Brown's Inlet or within one mile of Bear Inlet or Brown's Inlet, on the eastern or western beach of said inlets, except at regularly established fisheries on said Bear or Brown's Inlet beaches, or shall fish with seines or nets on the inside of said Bear or Brown's Inlet within one-fourth mile of said inlets between the first day of October and the first day of April, he shall be guilty of a misdemeanor.

1893, c. 216; 1903, c. 724; 1903, c. 416.

be amended by leaving out beginning with "person" in line one and ending with "North Carolina," line three (line 4 Revisal of 1905), and substituting in lieu thereof: "Shall set or fish any net or appliance of any kind for catching fish within one mile on either side to a line running westerly or southwesterly from the center of New Inlet to an intersection with the line extending from Big Island southeast (magnetic) or within one mile on either side of a line running westerly or southwesterly from the center of Oregon Inlet to a point two thousand yards west of the continuation of the said line running from Big Island south-southeast (magnetic) or within one mile on either side of a line six miles long running from the center of Hatteras Inlet through and beyond Hatteras Inlet Lighthouse, these restricted areas to include the channels extending from Oregon, New and Hatteras Inlets, respectively."

That Sections 2424, 2428, 2433 and 2452 be repealed for the reason that all the restrictions in these four sections are embodied in other sections of the Revisal for 1905.

Laws of 1907.—That Chapter 948

An Act to Regulate Fishing in the Waters of Pamlico, Tar, Neuse and Cape Fear Rivers, Pamlico Sound and Waters in Carteret County.—Section 1. That there shall be no pound- or other tarred-nets with a mesh smaller than one and one-half inches bar, before tarring, fished in Pamlico, Tar, and Neuse Rivers, Pamlico Sound and the waters of Carteret County, and there shall be no pound- or stake-nets fished within three miles of the inside mouths of Ocracoke Inlet nor in the principal channel or channels of said inlet nor within one mile of said channel or channels until the said channel or channels reach deep water, at any time, and the other inlets north of it shall be left under the Vann Bill, chapter two hundred and ninety-two, Laws of one thousand nine hundred and five.

Sec. 2. No stake- or pound-net which shall be fished in any of the waters mentioned in this act, without being tarred, shall have a mesh of less than one and three-eighths inches bar.

Sec. 3. That the bunt of all seines and haul-nets fished in the waters of Pamlico, Tar, and Neuse rivers and Pamlico Sound shall not be smaller than one and one-eighth inches bar net; *Provided*, this bunt shall not be longer than thirty yards; *Provided*, that nothing herein shall apply to nets fishing for menhaden.

Sec. 4. Any person violating any of the provisions of this act shall be guilty of a misdemeanor, and shall be fined not less than one hundred dollars and imprisoned at the discretion of the Court.

Sec. 5. That this act shall be in effect from and after January first, one thousand nine hundred and eight.

be amended by adding to Section 4: "*Provided*, that this chapter shall only apply to that part of the year beginning January 15 and ending May 15."

That in Chapter 977

An Act to Create a Fish Commissioner.—Section 7. *Power to Take Fish.* The Fish Commissioner and the United States Bureau of Fisheries may take and cause to be taken for scientific purposes, or for fish culture, any fish or other marine organism at any time from the waters of North Carolina, any law to the contrary notwithstanding.

shall be amended by adding to the clause of the section: "*Provided*, that permits to take fish as aforesaid will not be valid unless signed by the Commissioner of the U. S. Bureau of Fisheries and the Fish Commissioner of the State."

That Section

11 of Chapter 977, *License to fish*, be amended by adding to the clause of the section; "That all persons, firms or corporations securing license to fish under this act shall keep an account of the number of each kind of fish caught and the price received for same and on or before July 1 of each year, they shall furnish the Fish Commissioner with the total number of each kind of fish caught during the preceding year, or such part thereof as he or they have been engaged as aforesaid; they shall also furnish said Commissioner with such other information as may be required by said Commissioner relative to the number and value of boats or other apparatus used and number of men employed; that the Commissioner shall prepare and furnish to each person, firm or corporation so licensed to fish in the State the necessary blanks upon which to make said report."

That section

> **14 of Chapter 977, *License Tax.* The following license tax is hereby levied upon the different fishing appliances used in the waters of North Carolina: Anchor gill-nets, ten cents per one hundred yards or fraction thereof; stake gill-nets, ten cents per one hundred yards or fraction thereof; drift gill-nets, ten cents per one hundred yards or fraction thereof; pound-nets, one dollar each; seine and drag-nets over three hundred yards and under one thousand yards, one dollar and twenty-five cents per one hundred yards or fraction thereof; seine and drag-nets over one thousand yards, one dollar and seventy-five cents per one hundred yards or fraction thereof; fyke-nets, twenty-five cents each: *Provided,* this act shall not apply to the counties of Currituck, Camden, Carteret, Hyde, New Hanover, Craven, Onslow, Brunswick, Pender, Pamlico and Beaufort.**

be amended by inserting in line seven after "drag-nets" the following: "Under 100 yards, $1.00 each; seine and drag-nets over 100 yards and under 300 yards, $1.00 per hundred yards or fraction thereof"; and in line 10 after "each" insert the following: "minor-nets, 20 cents each."

NEW GENERAL LEGISLATION RECOMMENDED.

SECTION . . . . EARLY CLOSING SEASON FOR SHAD AND ALEWIFE OR HERRING.—All shad apparatus on the Cape Fear River below the mouth of Black River shall be taken out of the river by April first, and all above this point shall be taken out by April tenth; in Northeast Cape Fear River below Castle Hayne, all shad apparatus shall be taken out by April tenth, and all above that point by April twentieth; in the Black and other tributaries of the Cape Fear River all shad apparatus shall be taken out by April twentieth; in the Neuse River all gill-nets used for shad and alewife fishing shall be taken out of the river by April tenth; but all other shad and alewife apparatus in the Neuse River at or below the town of New Berne shall be taken out by May first, and all above that town by May tenth; in Pamlico and Pungo rivers, all gill-nets operated for shad and alewife fishing shall be taken out by April thirteenth, and all other alewife and shad apparatus shall be taken out by May first; in Tar River all shad and alewife apparatus shall be taken out of the river by May tenth; in Pamlico, Roanoke, Croatan, and Albemarle sounds east of Perquimans River on the north and Ship Point on the south (this to apply to the tributaries of the sound in this section), all gill-nets shall be taken out by April 13, and all other shad and alewife apparatus shall be taken out by May first, and in that portion of the Albemarle Sound west of the above points as far as Horney Blow Point on the north and Mackey's Creek on the south, all gill-nets shall be taken out by April eighteenth, and all other shad and alewife apparatus shall be taken out by May twelfth; thence west as far as the mouth of Chowan River, all gill-nets operated for shad and alewife fishing shall be taken out by April eighteenth, and all other shad and alewife apparatus shall be taken out by May twelfth, these dates to apply to the tributaries of this section of Albemarle Sound; in Chowan River all shad and alewife apparatus shall be taken out of the river by May fifteenth. If any person shall set or fish any net wilfully in violation of this section, he shall be guilty of a misdemeanor and fined not less than fifty dollars: *Provided,* that all pound-nets in any part of the waters mentioned in this section that are cut down in order to rid them of moss are to be considered as fulfilling the law.

SECTION . . . . DOUBLE SEINING.—All double seining in any of the waters or rivers of the State, and the hauling or drawing two seines in succession over the same bottom or within four hundred yards of that bottom is hereby prohibited; *Provided,* that the four-hundred-yard limit of this chapter does not apply to any place where conditions are such that the tide or current would occasionally carry one seine across a portion of the bottom that is being hauled by another seine; and any person violating this chapter shall for each violation be fined not less than two hundred and fifty dollars nor more than five hundred dollars.

SECTION . . . . PROTECTION OF STURGEON.—No person shall set or fish any sturgeon-net in the inland waters of North Carolina for a period of five years from the date of the passage of this act, and all sturgeons less than five feet long caught in any other manner whatever shall be returned to the water alive, and any person violating this section shall be guilty of a misdemeanor and fined not less than fifty dollars or imprisoned not less than twenty days; and the possession of any sturgeon less than five feet in length shall be *prima facie* evidence that the person having the same is violating this section. For the purposes of this act inland waters are defined as all waters of the State lying within the ocean inlets and the mouths of rivers and bays opening directly into the sea.

SECTION . . . . ROCKFISH.—If any person shall offer for sale any rockfish weighing less than one-half pound, he shall be guilty of a misdemeanor and be fined ten dollars for every offense.

SECTION . . . . PURSE-NET.—No person shall use or fish a purse-net for rockfish or perch in any of the waters in North Carolina, except in the open sea, and any person offending against this section shall be fined not less than fifty dollars for each offense.

SECTION . . . . SHAD AND HERRING.—Any person who shall catch or cause to be caught any shad or herring in the waters of the State of North Carolina for any other purpose than as food shall be guilty of a misdemeanor and fined not less than fifty dollars or imprisoned not less than thirty days.

SECTION . . . . FISHING ON SUNDAY.—If any person shall fish, haul, set, draw, or place in the water for fishing purposes, any net from midnight of Saturday night to midnight of Sunday night, he shall be guilty of a misdemeanor and fined not less than twenty-five dollars for each and every offense.

SECTION . . . . POUND-NETS ON EAST SIDE OF ROANOKE ISLAND.—It shall be unlawful to fish with Dutch,- pod,- fyke- or other pound-nets or nets of like kind in the waters east of Roanoke Island within the following boundaries: North from the north line five miles long west from Oregon Inlet mentioned in Section 2440 of the Revisal of 1905 to Mill Creek, except such as shall be fished not to exceed one thousand yards from the eastern shore of Roanoke Island.

SECTION . . . . CLOSED SEASON FOR FRESH-WATER FISH.—That if any person shall take or catch any fresh-water fish with any kind of net in the waters of North Carolina lying to the east of the 78th meridian of longitude from the first day of May to the first day of August of each year, he shall be guilty of a misdemeanor; *Provided,* that this does not prohibit the catching of fish with hook and line.

SECTION . . . . REMOVAL OF NETS.—The Fish Commissioner and his deputies are hereby empowered to remove any and all nets set in violation of any law and at the expense of the violator, all such laws to the contrary notwithstanding.

SECTION . . . . FINES.—That all fines, by whomsoever collected, penalties for violation of laws relating to fin fishing, shall be deposited in the State Treasury to the credit of the Fish Commission fund.

RESOLUTIONS RELATING TO THE TERRAPIN.

That Section 2370 of the Revisal of 1905

DIAMOND-BACK TERRAPIN PROTECTED.—If any person shall take or catch any diamond-back terrapin between the fifteenth day of April and the fifteenth day of August of any year, or any diamond-back terrapin at any time, of less size than five inches in length upon the bottom shell, or shall interfere with or in any manner destroy any eggs of the diamond-back terrapin, he shall be guilty of a misdemeanor, and shall be fined not less than five dollars nor more than ten dollars for each and every diamond-back terrapin so taken or caught, and a like sum for each and every egg interfered with or destroyed: *Provided,* this section shall not apply to parties empowered by the State to propagate the said diamond-back terrapin; and the possession of any diamond-back terrapin between the fifteenth days of April and August shall be *prima facie* evidence that the person having the same has violated this section. It shall be the duty of all sheriffs and constables to give immediate information to some justice of the peace of any violation of this section.

Code, s. 3377; 1899, c. 582; 1881, c. 115, ss. 1, 6.

be changed so that it will read as follows:

If any person shall take or catch or have in his possession any diamond-back terrapin between the first day of March and the thirty-first day of August of any year, or any diamond-back terrapin at any time, of less size than five inches in length upon the bottom shell, or shall interfere with, or in any manner destroy any eggs of the diamond-back terrapin, he shall be guilty of a misdemeanor, and shall be fined not less than five dollars, nor more than ten dollars, for each and every diamond-back terrapin so taken or caught, and a like sum for each and every egg interfered with or destroyed: *Provided,* that this section shall not apply to parties empowered by the State to propagate the said diamond-back terrapin; and the possession of any diamond-back terrapin between the first day of April and thirty-first day of August shall be *prima facie* evidence that the person having the same has violated this section: *Provided further,* that the provisions of this act shall apply to any person, firm, or corporation receiving or having for transportation undersized terrapins, or during the closed season terrapins of any size whatever. It shall be the duty of all sheriffs and constables to give immediate information to some justice of the peace of any violation of this section.

Resolutions Relating to the Oyster Industry.

That Section 2371 of the Revisal of 1905

Natural, Defined.—A natural oyster or clam bed, as distinguished from an artificial oyster or clam bed, shall be one not planted by man, and is any shoal, reef, or bottom where oysters are to be found growing in sufficient quantities to be valuable to the public.

1893, c. 287, s. 1.

be amended so as to read as follows:

In the waters of North Carolina a natural oyster reef or bottom shall be considered and defined as an area containing not less than a continuous area of one acre of the bottom on which oysters are found growing natural at the time or have been so found during a period of five years preceding the time at which the decision be made and in sufficient quantities to make their fishing profitable by means of hand-tongs on such ground as are reserved exclusively for tonging, or dredges on such beds as are designated for dredging: *Provided,* that no intervals of less than one hundred yards shall be considered as breaking the continuity of the bed.

That section

2393. Oysters, Where Purchased to Be Carried Out of the State.—If any person shall purchase and load on a vessel or boat any oysters to be carried out of the State in the shell, except at the following places, to-wit, the south end of Roanoke Island, Stumpy Point Bay, Parched Corn Bay, Wysocking Bay, West Bluff Bay, Great Island Narrows, or Swan Quarter Bay (as the Oyster Commissioner may determine), Portsmouth, Ocracoke, Bay River, mouth of Rose Bay, or Harbor Island; or if any person shall load more than one boat or vessel at any of said places at one and the same time, of if any person shall load any boat or vessel with oysters to be carried out of the State without such vessel having an inspector on board at the time the oysters are delivered, or shall carry any vessel loaded or partly loaded with oysters through the canals without a certificate showing that the oysters have been inspected and the taxes thereon paid, he shall be guilty of a misdemeanor, and be fined not more than fifty dollars or imprisoned not more than thirty days.

1903, c. 516, s. 17.

be repealed and the following substituted for it:

Any corporation domiciled in this State with their factories, shucking plants, and shipping depots located in this State, may enjoy the rights of fishing oysters from the natural reefs and of bedding oysters on leased bedding grounds: *Provided,* such oysters are canned, shucked, or packed in this State, or shipped raw in shells from a shipping depot in this State for consumption either in or out of this State; but no person, firm, or corporation shall ship oysters out of this State for canning or packing out of this State. As it is the desire of the State to encourage the planting of shells on barren bottoms in this State, no oysters in shell shall be shipped out of this State without the shipper first obtains from the Shellfish Commissioner of North Carolina permit so to do, and for which no charge shall be made by said Commissioner.

That sections

2401. Larceny of Oysters on Private Beds.—Any person who shall feloniously take, catch, or capture or carry away any shell-fish from the bed or ground of another, shall be guilty of larceny and punished accordingly.

1887, c. 119, s. 15.

and

2402. Oysters Caught at Night; Injury to Private Beds.—If any person shall wilfully commit any trespass or injury with any instrument or implement upon any ground upon which shell-fish are being raised or cultivated, or shall remove, destroy, or deface any mark or monument lawfully set up for the purpose of marking any grounds, or who shall work on any oyster-ground at night, he shall be guilty of a misdemeanor. But nothing in the provisions of this section shall be construed as authorizing interference with the capture of migratory fishes or free navigation or the right to use on any private grounds any method or implement for the taking, growing, or cultivation of shell-fish.

1887, c. 119, s. 11.

be repealed and the following substituted for them:

SECTION . . . . Any person who shall wilfully and without authority take or remove oysters from any land leased under the laws of the State of North Carolina, or shall wilfully injure or interfere with the oysters of such land in any manner, or injure oysters thereupon situated, or wilfully remove, alter, or interfere with the stakes, buoys, or monuments marking the same, shall, upon conviction thereof, for the first offense be sentenced to imprisonment in jail or in the penitentiary, in the discretion of the Court, for not less than three months and not more than two years, and for the second or any subsequent offense be sentenced to imprisonment in the penitentiary for not less than two years and not more than five years.

SECTION . . . . Any person who shall work a dredge, scrape, or pair of tongs or any other implement for the taking of oysters upon any land leased under the provisions of this act, without the consent of the lessee or owner, or who shall, while upon or sailing over any such ground or bed, cast, haul, or have overboard any such dredge, scrape, or pair of tongs or other implement for the taking of oysters under any pretense or for any purpose whatever, without the consent of such lessee or owner, upon conviction thereof shall for the first offense be fined not less than fifty dollars nor more than two hundred and fifty dollars or, in the discretion of the Court, be imprisoned in the jail.

That Section 2415 of the Revisal of 1905, which was amended in 1907 by striking out the words "two and a half" in lines three and four and inserting in lieu thereof "three" and by striking out the words "from hinge to mouth" in line four and inserting in lieu thereof "in longest diameter" is hereby amended by leaving out the amendment of 1907 and re-inserting the former words.

That Sections 2373, 2375, 2376, 2378, 2379, 2380 and 2426 are hereby repealed.

GENERAL OYSTER LAWS RECOMMENDED.

The convention adopted a resolution regarding the reorganization of the Shell-fish Commission.

The convention were of the opinion that a Shell-fish Commission should be established and inaugurated by the Legislature on similar lines as those relating to the formation of the Fish Commission; believing that if legislation is obtained regarding the cultivation of the oyster and the leasing of bottoms for that purpose, it will require the Shell-fish Commissioner and the Deputy Commissioner to devote all their time to the carrying out of the duties of their office, and it recommends the following:

1. NORTH CAROLINA SHELL-FISH COMMISSION.—The Shell-fish Commission shall, except as in this act otherwise provided, consist of a single Commissioner. He shall be appointed by the Governor by and with the advice and consent of the Senate within thirty days after the passage of this act. He shall be responsible for the carrying out of the duties of his office to the Geological and Economic Survey Board, and shall make semi-annual reports to them. The term of office of such Commissioner and his successors in office shall be four years or until their successors are appointed and qualified, and in case of vacancy in the office, the appointment shall be to fill the vacancy. The said Commissioner shall appoint a Deputy Commissioner, who, during the absence or inability to act of the Commissioner, shall have and exercise all of the powers of the Commissioner. The Shell-fish Commissioner and Deputy Commissioner shall each execute and file with the Secretary of State bonds in the sum of seven thousand and five thousand dollars, respectively, with sureties to be approved by the Secretary of State, conditioned for the faithful performance of their duties and to account for and pay over, pursuant to law, all moneys received by them in their office. The Shell-fish Commissioner shall take and subscribe an oath to support the Constitution and for the faithful performance of the duties of his office, which oath shall be filed with the bond. The Deputy Commissioner may be removed from his office for cause by the Commissioner, who may appoint his successor.

INSPECTORS, HOW APPOINTED; TERM, SALARY, BOND, OATH OF OFFICE.—The Shell-fish Commissioner shall appoint, from the counties within which they are to perform their duties, a sufficient number of inspectors, who shall serve during the oyster season, and may remove them for cause. He shall fix the compensation of the inspectors at not exceeding fifty dollars a month while on duty, and shall designate the length of service, the time when the inspectors go on duty and when they go off. The inspectors shall give bond in the sum of five hundred dollars, payable to the State of North Carolina, conditioned for the performance of the duties of their office, and the faithful accounting for all moneys received, which bond shall have at least two sufficient sureties, to be justified before, approved by, and filed with the Clerk of the Superior Court of the county where they reside, and shall take, subscribe, and file with such Clerk an oath of office. They shall be paid only for the time they serve.

OFFICE AND CLERICAL FORCE.—The Commissioner shall have an office in some town conveniently located to the oyster-beds of the State, and he is authorized to employ such clerks as may be necessary for the proper carrying on of the work of his office.

EQUIPMENT.—The Shell-fish Commissioner is authorized, by and with the consent of the Geological and Economic Survey Board, to purchase or rent such boats, dredges, and other equipment as may be necessary to enable him and his deputies to carry out the duties of his office as specified in this act.

DUTIES OF THE SHELL-FISH COMMISSIONER.—The Shell-fish Commissioner shall have a general supervision over every branch of the shell-fish industry, including the oyster, clam, scallop, and other mollusca, and see that the laws regulating the same are rigidly enforced. He shall collect and compile statistics showing the annual product of the oysters, clams, and other mollusca that are taken out of the waters of the State, and the capital invested and the apparatus employed; he shall have surveyed and marked in a prominent manner those areas of bottoms in the waters of the State in which oyster-tonging or dredging is prohibited by law, or those areas which are leased for the purpose of the cultivation of oysters or clams; he shall be responsible for the collection of all license fees, taxes, fines, or other imposts upon any of the shell-fish fisheries, and shall receive all fines imposed for the infraction of the shell-fish laws, and shall collect all rentals for bottoms leased for oyster or clam cultivation, and shall pay same into the State Treasury to the credit of the Shell-fish Commission fund to be drawn upon as directed by the Geological and Economic Survey Board; he shall see that the laws regulating the catching and handling of oysters, clams, and other mollusca are enforced; that no illegal methods are used in catching, selling, or shipping; that the cull law is rigidly enforced, and that only proper and legal methods are used in buying and selling. He shall prosecute all violations of the law, and whenever it is necessary he may employ counsel for this purpose. He shall in his official capacity have power to administer oaths and to send for and examine persons and papers; he shall, on or before the twenty-fifth day of each month, mail to the Treasurer of the State a consolidated statement showing the amount of taxes collected during the preceding month, and by and from whom collected. He shall make a semi-annual report to the Geological and Economic Survey Board, setting forth in detail an account of his official acts, the condition of the oyster and other shell-fish industries in all their branches, and shall recommend such additions to or modifications of existing laws relating thereto as he may deem proper and necessary.

ARRESTS WITHOUT WARRANT, WHEN AND HOW MADE.—The Shell-fish Commissioner, Deputy Commissioner, and inspectors shall have power, with or without warrants, to arrest any person violating the fishery laws.

POWER TO TAKE OYSTERS AND CLAMS.—The Shell-fish Commissioner and the United States Bureau of Fisheries may take and cause to be taken for scientific purposes any oysters, clam, or other mollusca at any time from the waters of the State, any law to the contrary notwithstanding; *Provided* that the permits issued shall be signed by the Commissioner of the U. S. Bureau of Fisheries and the North Carolina Shell-fish Commissioner.

SALARIES.—The salary of the Shell-fish Commissioner shall be fifteen hundred dollars per year and the expenses necessarily incurred by him in the discharge of his duties. The salary of the Deputy Shell-fish Commissioner shall be nine hundred dollars per year and the expenses necessarily incurred by him in the discharge of his duties. The salaries of clerks and of scientific assistants which may be employed from time to time are to be fixed by the Geological and Economic Survey Board.

NO INTEREST IN OYSTER, CLAM, OR OTHER MOLLUSCA FISHERIES.—The Shell-fish Commissioner, Deputy Commissioner, and inspectors shall not be interested in any oyster, clam, or other mollusca fishing industry in North Carolina.

REVENUE.—All license fees, taxes, rentals of oyster and clam bottoms, fines or other imposts upon the oyster, clam, scallop, and other mollusca fisheries, or fines imposed for infraction of the oyster, clam, and other mollusca fishery laws, in whatever manner collected, shall be paid to the State Treasurer to the credit of the Shell-fish Commission fund, to be drawn upon as directed by the Geological and Economic Survey Board, and shall constitute the revenue of the Shell-fish Commission.

If the organization of a Shell-fish Commission as outlined above is incorporated, then Sections 2398, 2403, 2404, 2405, 2406, 2407, 2422, which are given beyond, should be repealed.

CULTIVATION OF THE OYSTER AND CLAM.

The following legislation is urgently recommended by the convention as being the most practical for encouraging and stimulating oyster and clam culture in North Carolina and as being the best means for building up and increasing the productivity of the natural oyster beds.

CHAPTER . . . .

SECTION 1. SHELL-FISH COMMISSIONER CAN LEASE BOTTOMS.—The Shell-fish Commisioner shall have power to lease to any duly qualified person, firm, or corporation, for purposes of oyster or clam culture, any bottom of the waters of the State not a natural oyster-bed as defined in this act, nor a clam reservation as defined in this act, in accordance with the provisions of this law.

SEC. 2. LEASING OF BOTTOMS.—Any citizen of North Carolina or firm or corporation organized under the laws of the State and doing business within its limits shall be granted the privilege of taking up bottoms for purposes of oyster or clam culture under the provisions of this act of an area not less than one acre nor more than fifty acres, with the exception of the open waters of Pamlico Sound (and for the purposes of this act open waters of Pamlico Sound shall mean the waters that are outside of two miles of the shore line), in which the minimum limit shall be five acres and the maximum shall be two hundred acres: *Provided,* that the limit of entry in Core Sound, North River, Newport River, Bogue Sound, and all bays and creeks bordering on these waters, and in Jones Bay, Rose Bay, Abels Bay, Swan Quarter Bay, Middle Bay, Bay River, Deep Bay, Juniper Bay, West and East Bluff Bays, Wysocking Bay, Fire Creek, Stumpy Point Bay, Mouse Harbor Bay, Maw Bay, and Broad Creek tributaries of Pamlico Sound, shall be one acre as a minimum and ten acres as a maximum: *Provided further,* however, that at the end of one year from the passage of this act that the minimum area in Core Sound, North River, Newport River, Bogue Sound, and all bays and creeks bordering on these waters, and in Jones Bay, Rose Bay, Abels Bay, Swan Quarter Bay, Middle Bay, Bay River, Deep Bay, Juniper Bay, West and East Bluff Bays, Wysocking Bay, Fire Creek, Stumpy Point, Mouse Harbor Bay, and Maw Bay, and Broad Creek tributaries of Pamlico Sound, shall be one acre and the maximum fifty acres; but no person, firm, corporation, or association shall severally or collectively hold any interest in any lease or leases aggregating an area of greater than fifty acres, except in the open waters of Pamlico Sound, where the aggregate area shall be two hundred acres.

SEC. 3. LEASE, HOW OBTAINED.—Such persons, firms, or corporations desiring to avail themselves of the privileges of this act shall make written application on a form to be prepared by the Shell-fish Commissioner, setting forth the name and address of the applicant, describing as definitely as may be the location and extent of the bottom for which application is made, and requesting the survey and leasing to the applicant of said bottom. As soon as possible after the application is received the Shell-fish Commissioner shall cause to be made a survey and map of said bottom at the expense of the applicant. The Shell-fish Commissioner shall also thoroughly examine said bottoms by sounding and by dragging thereover a chain to detect the presence of natural oysters. Should any natural oysters be found, the Commissioner shall cause examination to be made to ascertain the area and density of oysters on said bottom or bed to determine whether the same is a natural bed under the definition contained in this act. He shall be assisted in this examination on tonging ground by an expert tonger to be appointed by the Board of County Commissioners of the county in which said bottom or the greater portion thereof is located, and the question as to whether the oyster growth is sufficiently dense to fall within the definition of the natural bed shall be determined by the quantity of oysters which the said expert tonger may be able to take in a specified time; and on dredging-ground the Commissioner shall be assisted by an expert dredger, appointed by the Board of County Commissioners of the county in which said bottom or the greater portion thereof is located, and the question as to whether the oyster growth is sufficiently dense to fall within the definition of the natural bed shall be determined by the quantity of oysters which the said expert dredger may be able to take in a specified time. The Shell-fish Commissioner shall require the bodies of bottoms applied for to be as compact as possible, taking into consideration the shape of the body of water and the consistency of the bottom. No application shall be entertained nor lease granted for a piece of bottom within two hundred yards of a known natural bottom, bed, or reef. A deposit of ten dollars will be required of each applicant at the time of making his application, said sum to be credited to the cost of the survey of the bottom applied for.

SEC. 4. MARKING AND STAKING OF LEASED BOTTOMS.—Immediately upon the completion of the survey and the mapping thereof and the payment by the applicant of the cost of said survey and map, the Shell-fish Commissioner shall execute to the applicant, upon a form approved by the Attorney-General of the State, a lease for the bottoms applied for. A copy of the lease, map of the survey, and a description of the bottom, defining its position, shall be filed in the office of the Shell-fish Commissioner. After the execution of said lease, the lessee shall have the sole right and use of said bottoms, and all shells, oysters, and cultch thereon, or placed thereon, shall be his exclusive property so long as he complies with the provisions of this law. The lessee shall stake off and mark the bottoms leased in the manner prescribed by the Shell-fish Commissioner, and failure to do so within a period of thirty days of an order so to do issued by the Commissioner shall subject said lessee to a fine of five dollars per acre for each sixty days' default in compliance with said order. The corner stakes, at least, of each lease shall be marked with signs plainly displaying the number of the lease and the name of the lessee. The lessee shall within two years of the commencement of his lease have planted upon his holdings a quantity of shells equal to an average of fifty bushels of seed oysters or shells per acre of holdings, and within four years from the commencement of his lease, a quantity of oysters or shells equal to an average of not less than one hundred and twenty-five bushels per acre. The Oyster Commissioner shall, upon granting any lease, publish a notice of the granting of same in a newspaper of general circulation in the county wherein the bottom leased is located.

SEC. 5. TERM OF LEASE, RENTAL.—All leases made under the provisions of this act shall begin upon the issuance of the lease and shall expire on the first day of April of the twentieth year thereafter. The rental shall be at the rate of one dollar per acre per year for the first ten years and two dollars per acre per year for the next ten years of the lease, payable annually in advance on the first day of April of each year: *Provided,* that in the open waters of Pamlico Sound—and for the purposes of this act the open waters of Pamlico Sound shall mean the waters that are outside the two miles of the shore line—the rental shall be at the rate of fifty cents per acre per year for the first three years; one dollar per acre per year for the next seven years; and two dollars per acre per year for the next ten years of the lease. This rental shall be in lieu of all other taxes and imposts whatever and shall be considered as all and the only taxation which can be imposed by the State, counties, municipalities, or other subordinate political bodies. The rental for the first year shall be paid in advance to an amount proportional to the unexpired part of the year to the first of April next succeeding.

SEC. 6. TRANSFER OF LEASE, INHERITANCE OF LEASE.—The said lease shall be heritable and transferable, in whole or in part, provided the qualifications of the heirs and transferees are such as are described by this act. Non-residents, acquiring by inheritance or process sale, or persons already holding the maximum area permitted by this act, shall within a period of twelve months from time of acquisition dispose of said prohibited or excess of holding to some qualified person, firm, or corporation, under penalty of forfeiture. The lease shall be subject to mortgage, pledge, seizure for debt, and the same other transactions as are other property rights in North Carolina. No transfer shall be of effect, unless of court record, until entered on the books of the Shell-fish Commissioner.

SEC. 7. RE-LEASING OF BOTTOMS.—The term of each lease granted under the provision of this act shall be for a period of twenty years from the first day of April preceding the date of granting of said lease. At the expiration of the first lease the lessee, upon making written application on the prescribed form, shall be entitled to successive leases on the same terms as applied to the last ten years of the first lease, for a period not exceeding ten years each.

SEC. 8. FORFEITURE OF LEASE.—The failure to pay the rental of bottoms leased for each year in advance on or before the first day of April or within thirty days thereafter shall *ipso facto* cancel said lease and shall forfeit to the State the said leased bottoms and all oysters thereon, and upon said forfeiture the Shell-fish Commissioner is hereby authorized to lease the said bottoms to any qualified applicant therefor: *Provided,* that no forfeiture shall be valid, however, under the provisions of this section, unless there shall have been mailed by the Shell-fish Commissioner to the last address of the lessee upon the books of the Commissioner a thirty days' notice of the maturity of said rental.

SEC. 9. TITLE SECURE.—If any person within four months of the publication of the notice of granting of any lease make claim that a natural oyster bottom, bed, or reef exists within the boundaries of said lease, he shall under oath state his claim and request the Shell-fish Commissioner to cancel said lease: *Provided, however,* that each such claim and petition shall be accompanied by a deposit of twenty-five dollars. No petition unaccompanied by said deposit shall be considered by the Commissioner. The Shell-fish Commissioner shall in person examine into said claim, and, if the decision should be against the claimant, the deposit of twenty-five dollars shall be forfeited to the State and deposited to the credit of the Shell-fish Commission fund. Should, however, the claim be sustained and a natural bed be found within the boundary of the lease, the said natural bed shall be surveyed and marked with stakes or buoys at the expense of the lessee, and the said natural bed be thrown open to the public fishery. If no such claim be presented within a period of four months, or if when so presented it fail of substantiation as provided, the lessee shall thereafter be secure from attack on such account and his lease shall be incontestable so long as he complies with the other provisions of this act. In each and every such case the decision of the Shell-fish Commissioner shall be subject to review and appeal before a Judge of the Superior Court, who shall render a decision without the aid of a jury, and his decision shall be final.

SEC. 10.—That all laws and clauses of laws in so far as they are in conflict with this act are hereby repealed.

The laws that should be repealed, if the above chapter is passed, are Sections 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380 and 2382.

CHAPTER . . . .

SECTION 1.—That the Oyster Commissioner is hereby authorized to employ collectors at the smaller places to collect the oyster tax on a commission basis, the amount of the commission to be determined at the discretion of the Oyster Commissioner; *Provided,* that at least 10 per cent and not over 40 per cent of the amount collected can be allowed the collector.

SEC. 2.—The State of North Carolina shall exercise exclusive jurisdiction and control over all the shell-fisheries of the State wherever located, whether these fisheries be for oysters, clams, scallops, or any other mollusca whatever.

SEC. 3. DELIVERY OF OYSTERS WITHOUT INSPECTION.—If any boatman shall deliver oysters to any one before they have been inspected by the inspector, he shall be guilty of a misdemeanor, and fined not less than fifty dollars: *Provided,* that in case the boatman is unable to find the inspector, he (the boatman) can deliver the oysters and report to the inspector afterwards, but within forty-eight hours of delivery of oysters.

SEC. 4.—All these acts relating to the fish, oyster, and clam are to be effective as soon as they have been ratified.

SPECIAL RESOLUTIONS PASSED BY THE CONVENTION.

WHEREAS, That the fish and oyster industries of North Carolina are of very great importance and value to the State; and

WHEREAS, There has been a general decline in the value of these industries for the past few years; and

WHEREAS, It is believed that by proper legislation these industries can be built up and brought to such condition that the State will derive considerable revenue from them;

It is hereby Resolved, That the General Assembly, at its session of 1909, consider most carefully the recommendations of this convention, which have the endorsement of the U. S. Bureau of Fisheries, and that they take up these recommendations and act upon them immediately.

And be it further Resolved, That the Speaker of the House and the President of the Senate be requested to appoint a joint committee of members not only from the eastern portion of the State but also from the central and western portions who will go over these recommendations of the convention; confer with the Fish Commissioner, Oyster Commissioner and State Geologist; and embody these recommendations in one general bill to be acted upon by the General Assembly.

WHEREAS, It will be of advantage to the committees on fish and oyster of the General Assembly of 1909 to have all information possible relating to these industries;

It is hereby Resolved, That the Fish Commissioner, Oyster Commissioner and State Geologist be requested to be ready to give all information possible to these committees when so requested.

Whereas, It is believed that it is to the best interests of the State that all counties be under the jurisdiction of the Fish Commission;

It is hereby Resolved, That all counties be requested and urged through their members in the General Assembly to come under the jurisdiction of the Fish Commission and assist in its work, which is the building up and increasing in value the fishing industries of the State.

Whereas, It is believed the oyster industry can be made a source of income to the State; *Provided,* the laws are enforced;

It is hereby Resolved, That the General Assembly of 1909 be petitioned to make a sufficient appropriation for two years to support the Oyster Commission so that it will be enabled to enforce the laws and collect the oyster tax and be in a position to carry out the work of the Commission to the best interests of the State; and that the amount required be recommended by the Oyster Commissioner.

PUBLICATIONS

OF THE

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

BULLETINS.

1. Iron Ores of North Carolina, by Henry B. C. Nitze, 1893. 8°, 239 pp., 20 pl., and map. *Postage 10 cents.*

2. Building and Ornamental Stones in North Carolina, by T. L. Watson and F. B. Laney in collaboration with George P. Merrill, 1906. 8°, 283 pp., 32 pl., 2 figs. *Postage 25 cents. Cloth-bound copy 30 cents extra.*

3. Gold Deposits in North Carolina, by Henry B. C. Nitze and George B. Hanna, 1896. 8°, 196 pp., 14 pl., and map. *Out of print.*

4. Road Material and Road Construction in North Carolina, by J. A. Holmes and William Cain, 1893. 8°, 88 pp. *Out of print.*

5. The Forests, Forest Lands and Forest Products of Eastern North Carolina, by W. W. Ashe, 1894. 8°, 128 pp., 5 pl. *Postage 5 cents.*

6. The Timber Trees of North Carolina, by Gifford Pinchot and W. W. Ashe, 1897. 8°, 227 pp., 22 pl. *Postage 10 cents.*

7. Forest Fires: Their Destructive Work, Causes and Prevention, by W. W. Ashe, 1895. 8°, 66 pp., 1 pl. *Postage 5 cents.*

8. Water-powers in North Carolina, by George F. Swain, Joseph A. Holmes and E. W. Myers, 1899. 8°, 362 pp., 16 pl. *Postage 16 cents.*

9. Monazite and Monazite Deposits in North Carolina, by Henry B. C. Nitze, 1895. 8°, 47 pp., 5 pl. *Postage 4 cents.*

10. Gold Mining in North Carolina and other Appalachian States, by Henry B. C. Nitze and A. J. Wilkins, 1897. 8°, 164 pp., 10 pl. *Postage 10 cents.*

11. Corundum and the Basic Magnesian Rocks of Western North Carolina, by J. Volney Lewis, 1895. 8°, 107 pp., 6 pl. *Postage 4 cents.*

12. History of the Gems Found in North Carolina, by George Frederick Kunz, 1907. 8°, 60 pp., 15 pl. *Postage 8 cents. Cloth-bound copy 30 cents extra.*

13. Clay Deposits and Clay Industries in North Carolina, by Heinrich Ries, 1897. 8°, 157 pp., 12 pl. *Postage 10 cents.*

14. The Cultivation of the Diamond-back Terrapin, by R. E. Coker, 1906. 8°, 67 pp., 23 pl., 2 figs. *Postage 6 cents.*

15. Experiments in Oyster Culture in Pamlico Sound, North Carolina, by Robert E. Coker, 1907. 8°, 74 pp., 17 pl., 11 figs. *Postage 6 cents.*

16. Shade Trees for North Carolina, by W. W. Ashe, 1908. 8°, 74 pp., 10 pl., 16 figs. *Postage 6 cents.*

17. Terracing of Farm Lands, by W. W. Ashe, 1908. 8°, 38 pp., 6 pl., 2 figs. *Postage 4 cents.*

18. A List of Elevations in North Carolina, by Joseph Hyde Pratt. *In preparation.*

19. The Tin Deposits of the Carolinas, by Joseph Hyde Pratt and Douglass B. Sterrett, 1905. 8°, 64 pp., 8 figs. *Postage 4 cents.*

20. The Loblolly Pine in Eastern North Carolina, by W. W. Ashe. *In preparation.*

ECONOMIC PAPERS.

1. The Maple-Sugar Industry in Western North Carolina, by W. W. Ashe, 1897. 8°, 34 pp. *Postage 2 cents.*

2. Recent Road Legislation in North Carolina, by J. A. Holmes. *Out of print.*

3. Talc and Pyrophyllite Deposits in North Carolina, by Joseph Hyde Pratt, 1900. 8°, 29 pp., 2 maps. *Postage 2 cents.*

4. The Mining Industry in North Carolina During 1900, by Joseph Hyde Pratt, 1901. 8°, 36 pp., and map. *Postage 2 cents.*

5. Road Laws of North Carolina, by J. A. Holmes. *Out of print.*

6. The Mining Industry in North Carolina During 1901, by Joseph Hyde Pratt, 1902. 8°, 102 pp. *Postage 4 cents.*

7. Mining Industry in North Carolina During 1902, by Joseph Hyde Pratt, 1903. 8°, 27 pp. *Postage 2 cents.*

8. The Mining Industry in North Carolina During 1903, by Joseph Hyde Pratt, 1904. 8°, 74 pp. *Postage 4 cents.*

9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

10. Oyster Culture in North Carolina, by Robert E. Coker, 1905. 8°, 39 pp. *Postage 2 cents.*

11. The Mining Industry in North Carolina During 1905, by Joseph Hyde Pratt, 1906. 8°, 95 pp. *Postage 4 cents.*

12. Investigations Relative to the Shad Fisheries of North Carolina, by John N. Cobb, 1906. 8°, 74 pp., 8 maps. *Postage 6 cents.*

13. Report of Committee on Fisheries in North Carolina. Compiled by Joseph Hyde Pratt, 1906. 8°, 78 pp. *Postage 4 cents.*

14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt. *In preparation.*

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina. Compiled by Joseph Hyde Pratt, 1908. 8°, 45 pp., 1 pl. *Postage 4 cents.*

VOLUMES.

Vol. 1. Corundum and the Basic Magnesian Rocks in Western North Carolina, by Joseph Hyde Pratt and J. Volney Lewis, 1905. 8°, 464 pp., 44 pl., 35 figs. *Postage 32 cents. Cloth-bound copy 30 cents extra.*

Vol. II. Fishes of North Carolina, by H. M. Smith, 1907. 8°, 453 pp., 21 pl., 188 figs. *Postage 30 cents.*

Vol. III. Miscellaneous Mineral Resources in North Carolina, by Joseph Hyde Pratt. *In preparation.*

Samples of any mineral found in the State may be sent to the office of the Geological and Economic Survey for identification, and the same will be classified free of charge. It must be understood, however, that NO ASSAYS, OR QUANTITATIVE DETERMINATIONS, WILL BE MADE. Samples should be in a lump form if possible, and marked plainly on outside of package with name of sender, post-office address, etc.; a *letter* should accompany sample and *stamp* should be enclosed for reply.

These publications are mailed to libraries and to individuals who may desire information on any of the special subjects named, free of charge, except that in each case applicants for the reports should forward the amount of *postage* needed, as indicated above, for mailing the bulletins desired, to the *State Geologist, Chapel Hill, N. C.*

PROCEEDINGS OF DRAINAGE CONVENTION HELD AT NEWBERN, NORTH CAROLINA, SEPTEMBER 9, 1908

COMPILED BY
JOSEPH HYDE PRATT

NORTH CAROLINA GEOLOGICAL AND
ECONOMIC SURVEY

JOSEPH HYDE PRATT, STATE GEOLOGIST

ECONOMIC PAPER NO. 17

Proceedings of Drainage Convention Held at Newbern, North Carolina, September 9, 1908

COMPILED BY
JOSEPH HYDE PRATT

RALEIGH
E. M. Uzzell & Co., State Printers and Binders
1908

N 557
N813e

GEOLOGICAL BOARD

Governor R. B. Glenn, *ex officio Chairman*	Raleigh.
Henry E. Fries	Winston-Salem.
Frank R. Hewitt	Asheville.
Hugh MacRae	Wilmington.
Frank Wood	Edenton.

Joseph Hyde Pratt, State Geologist	Chapel Hill.

LETTER OF TRANSMITTAL

CHAPEL HILL, N. C., December 1, 1908.

To His Excellency, HON. ROBERT B. GLENN,
Governor of North Carolina.

Sir.—I herewith submit the report of the Proceedings of the Drainage Convention that was held at Newbern, N. C., September 9 and 10. In this report are given the addresses delivered at the Convention and also the legislation recommended. On account of the value of this report to the question of drainage in eastern North Carolina, I recommend that it be published as Economic Paper No. 17 of the publications of the North Carolina Geological and Economic Survey.

Yours respectfully,
JOSEPH HYDE PRATT,
State Geologist.

CONTENTS

PAGE

INTRODUCTION 9

PROCEEDINGS OF THE CONVENTION 10

- Purpose of the Convention, by Joseph Hyde Pratt 10
- Organization of the Convention 12
- Address of Welcome, by M. H. Allen 15
- Address by Congressman John H. Small 17
- How to Drain our Swamp Lands, by J. O. Wright, Drainage Engineer. 24
- Appointment of Committees on Legislation and Resolutions 32
- Address by Senator F. M. Simmons 32
- Address by Congressman Charles R. Thomas 39
- Cost and Value of Drainage, by E. W. Myers, Consulting Engineer... 43
- Drainage of Swamp Lands and its Relation to Public Health, by Dr. Francis Duffy 52
  - Discussion by Dr. Caton 56
- Address by Congressman H. L. Godwin 57
- Practical Results of Drainage, by J. A. Wilkinson 60
- Report of Committee on Resolutions 61
- Report of Committee on Legislation 64
  - Legislation recommended by Committee 64
- Assessment of Benefits and Damages in a Public Drainage District, by J. O. Wright 79

PROCEEDINGS OF DRAINAGE CONVENTION

CALLED BY THE GEOLOGICAL BOARD AND HELD AT NEWBERN, N. C., SEPTEMBER 9 AND 10, 1908.

COMPILED BY JOSEPH HYDE PRATT, STATE GEOLOGIST.

INTRODUCTION.

The State Geological and Economic Survey has been interested in the subject of drainage for the past four years and has given special attention to the problem of drainage of certain of the swamp lands belonging to the State Board of Education. During this investigation the State Geologist was impressed with the enormous amount of swamp land in eastern North Carolina and its present unproductiveness. It was also observed that much of this swamp area was capable of being drained and would then make good agricultural lands; but that there were no adequate laws in the State which would warrant any one undertaking the drainage of any swamp area.

Realizing these conditions and also realizing what it would mean to eastern North Carolina if certain of these swamp areas were drained, the Geological Board at its June meeting authorized the State Geologist to call a meeting to be held at some central point in eastern North Carolina to consider the drainage problem and to recommend legislation that would make the drainage of these swamp areas practical. While this meeting was open to all who wished to attend, two or more special delegates were appointed from the twenty-eight counties in eastern North Carolina that contained swamp areas.

The following letter was sent out to each of these delegates:

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

CHAPEL HILL, N. C., July 24, 1908.

Dear Sir.—At the June meeting of the Geological Board the State Geologist was authorized to call a meeting to be held at some suitable point in eastern North Carolina to which delegates would be appointed to take up a discussion relating to legislation that may be deemed necessary to give to North Carolina such laws as will make it possible to carry out profitably the drainage of swamp and overflow lands. This meeting will be held at Newbern, N. C., September 9 and 10, at the Hotel Gaston.

I shall appreciate it if you will attend this meeting as a delegate. There are no funds available for paying expenses of delegates and you will, therefore, have to defray your own expenses at the meeting.

Trusting to hear that you can attend this convention, which I consider of the utmost importance to North Carolina, I beg to remain,

Yours very truly,
JOSEPH HYDE PRATT,
State Geologist.

In response to this letter, over forty delegates attended the convention.

PROCEEDINGS OF THE CONVENTION.

The first meeting was called to order Wednesday morning, September 9, at 10: 30 o'clock, in the court house, by Joseph Hyde Pratt, State Geologist. In calling the meeting to order, Mr. Pratt spoke something as follows:

PURPOSE OF THE CONVENTION.

BY JOSEPH HYDE PRATT, STATE GEOLOGIST.

This convention has been called to discuss a most important question, and one that is interesting not only many States but the Federal Government.

Although the question of drainage comes home more forcibly to the people of eastern North Carolina than any other portion of the State on account of the very large area of swamp lands in that section, it is a question of importance to all the people of the State, inasmuch as it means the reclamation not only of swamp lands but also of "overflow" lands. There are approximately 4,505 square miles of swamp lands in North Carolina, besides thousands of acres of "overflow" lands, many of which are susceptible to reclamation, if properly drained. In many instances, no engineering difficulty has stood in the way of draining a particular piece of land, but absence of adequate laws. There is no general drainage law in North Carolina, although several counties and townships have had laws passed relating to the drainage of areas within their borders. Thus, it has happened quite frequently that a scheme for draining certain areas has had to be abandoned because, in order to carry out successfully the plan of drainage, it would be necessary to go beyond the boundary line of the township or county and in this adjacent territory there were no laws relating to drainage. If these large areas in the State are to be successfully drained, it will be necessary to have some general legislation passed covering the whole State with certain supplementary laws to govern certain local conditions. There is no doubt but that the Federal Government is beginning to take a most decided interest in the reclamation of swamp lands and, when Congress passes laws permitting Federal aid to States in the reclamation of swamp lands, it is those States that have practical drainage laws that will undoubtedly be the first to obtain co-operative aid from the Federal Government.

When we consider the area of swamp lands in North Carolina, that it is nearly as great as that of the kingdom of Saxony, which has nearly 5,000,000 people, it will be seen that the State has the opportunity of developing an area which is capable of supporting a population that is larger than the present population of the whole State. Although some of the swamp areas do not contain land that is very well adapted to agricultural purposes, still there are vast areas which, if drained, would be capable of growing a vast variety of products. They would not be far from railroads so that the products of the farms could be easily marketed.

A large proportion of the swamp lands is sufficiently elevated above the neighboring water courses to make drainage feasible, but usually this is beyond the reach of the individual. It is possible to accomplish this if the laws of the State will permit different interests joining together to carry out these large drainage schemes and to issue bonds to obtain the necessary funds to accomplish their end.

Congressmen Small, Thomas and Godwin, of the First, Third and Sixth districts, respectively, are heartily in accord with what is being done in regard to drainage in the State, and have worked zealously for the success of this movement. Mr. Small especially has carried on a very vigorous campaign for practical drainage. He has had Mr. J. O. Wright, of the U. S. Bureau of Agriculture give a great many addresses in his district on the question of drainage, which have aroused considerable interest in this important work. Mr. Godwin has also most thoroughly identified himself with the reclamation of swamp lands in North Carolina, and in March, 1906, made a speech on the floor of the House of Representatives favoring Federal aid to States in the reclamation of their swamp lands.

Many of the States have already taken up the question of drainage and have passed satisfactory laws which are resulting in the reclamation of large areas of otherwise valueless lands, and this has meant a considerable increase in the revenue of the State. It is my desire that the result of this convention will be the passage of adequate laws at the General Assembly of 1909 which will permit of the drainage of our vast swamp areas, thus bringing them into cultivation and by this means add a considerable revenue to the State from a source which is now yielding practically nothing.

The 4,505 square miles of swamp land in eastern North Carolina is in 28 counties as follows:

County.	Sq. mi.	County.	Sq. mi.
Beaufort	177	Jones	139
Bertie	57	Martin	86
Bladen	192	New Hanover	25
Brunswick	300	Onslow	134
Camden	162	Pamlico	325
Carteret	126	Pasquotank	80
Chowan	80	Pender	370
Columbus	300	Perquimans	92
Craven	238	Pitt	40
Cumberland	30	Robeson	130
Currituck	40	Sampson	18
Dare	344	Tyrrell	251
Duplin	125	Washington	262
Gates	45		——
Hyde	387	Total	4,505

or 2,883,200 acres.

The drainage of this vast swamp area means not only additional wealth to the State in the form of reclaimed agricultural lands, but it will mean improved roads in large areas that are now almost impassable and inaccessible; it will mean better school facilities for our children; and it will also greatly improve the healthfulness of those sections of the State.

On motion of Congressman Charles R. Thomas, the temporary chairman appointed committees on permanent organization and credentials as follows:

Permanent Organization.—C. R. Thomas, chairman; R. H. Morgan, S. W. Wilkinson, J. G. Butler and E. W. Myers.

Credentials.—E. H. Meadows, chairman; W. W. Ashe and S. W. Woodley.

The Committee on Permanent Organization reported the following permanent officers:

Chairman: Joseph Hyde Pratt, State Geologist, of Chapel Hill.

Secretary: G. V. Richardson, Dover.

Vice-Presidents: P. H. Morgan, Currituck County; F. F. Cahoon, Pasquotank County; John A. Wilkinson, Beaufort County; W. F. Davenport, Washington County; A. B. Croom, Jr., Pender County; J. J. Wolfenden, Craven County; E. M. Koonce, Onslow County; John C. Parker, Jones County; W. S. Chadwick, Carteret County; J. G. Butler, Columbus County; P. Rourk, Brunswick County; S. S. Mann, Hyde County; O. L. Clark, Bladen County; Dr. H. C. Lilly, Cumberland County.

The Committee on Credentials reported the following delegates present, representing their respective counties:

Beaufort County:
Congressman John H. Small, Washington.
H. C. Carter, Jr., Washington.
J. A. Wilkinson, Belhaven.
S. W. Wilkinson, Belhaven.

Bladen County:
O. L. Clark, Clarkton.

Brunswick County:
P. Rourk, Shallotte.

Camden County:
W. G. Ferebee, Gregory.

Carteret County:
W. S. Chadwick, Beaufort.

Columbus County:
J. G. Butler, Pireway.

Craven County:
Congressman C. R. Thomas, Newbern.
G. V. Richardson, Dover.
T. A. Green, Newbern.
A. D. Ward, Newbern.
E. H. Meadows, Newbern.
J. J. Wolfenden, Newbern.

Currituck County:
A. B. Lukens, Moyock.
R. O. Bayley, Moyock.
C. R. Vandecarr, Moyock.
P. H. Morgan, Shawboro.

Greene County:
D. M. Patrick, Snow Hill.

Guilford County:
E. W. Myers, Greensboro.

Harnett County:
Congressman H. L. Godwin, Dunn.

Hyde County:
S. S. Mann, Swanquarter.
F. H. B. Gibbs, Fairfield.
E. P. Carter, Fairfield.

Jones County:
Senator F. M. Simmons, Trenton.
T. D. Warren.
John C. Parker, Olivers.

New Hanover County:
J. A. Taylor, Wilmington.

Onslow County:
E. M. Koonce, Jacksonville.

Orange County:
Joseph Hyde Pratt, Chapel Hill.

Pamlico County:
J. F. Cowell, Bayboro.
William Brinson, Reelsboro.

Pasquotank County:
F. F. Cohoon, Elizabeth City.

Pender County:
A. B. Croom, Jr., Burgaw.

Wake County:
W. W. Ashe, Raleigh.

Washington County:
S. W. Woodley, Cherry.
A. G. Walker, Creswell.
John Phelps.
W. S. Davenport, Plymouth.

J. O. Wright, Washington, D. C.

The reports of the committees were unanimously adopted.

On the adoption of the report of the Committee on Permanent Organization, Mr. Pratt expressed his appreciation of the honor of being made chairman of the convention and said, among other things, that he hoped to see a bill pass the Legislature of 1909 which will permit of the drainage of the swamp lands of North Carolina. He then called upon Attorney M. H. Allen, who made the address of welcome in the absence of Mayor Jas. A. Bryan. Mr. Allen spoke as follows:

ADDRESS OF WELCOME.

BY MR. M. H. ALLEN.

Gentlemen of the Drainage Convention:

The distinguished citizen who should have greeted you being for good reasons absent, it has become my duty to imperfectly fill his place. A most pleasant duty, so far as the expression of kind feeling is concerned, and undeserved duty, if I look to the comparison you must draw between the Mayor of this city and an ordinary layman.

Both Newbern and Craven County congratulate themselves upon furnishing the forum in which shall be considered the great question of the drainage of our swamp lands—a matter which pertains to the welfare of the whole of this great eastern section.

This age has been correctly denominated the age of experiment and advancement. The human mind seems to have burst its ancient limit and to be travelling over the face of the material and intellectual creation in search of the means of progress. In this section of North Carolina we have thousands and thousands of acres of the richest lands on the continent which, in its present condition, is of no value to the owner because it is not drained. The small farmer is unable to drain great bodies of land belonging to others in order to improve his own. Our Government has seen fit to loan millions of dollars toward the irrigation of the arid lands of the far West, and, if it can do so much for the people of that section of the country, may we not expect it to lend us a helping hand? If the laws enacted as a result of this meeting will so fix it that the small farmer can drain his land without the expense of draining the lands of others, we will see a wave of prosperity sweep over this section such as was never seen before.

We welcome you within our borders and extend to you a cordial appreciation and wish you every pleasure of success in your deliberations. Results are already guaranteed by the personnel of this assembly. When we see such men as you assemble in the interest of any cause, we are assured of the result. You must not forget, however, that you come upon a two-fold mission, first business and second, pleasure. I have the pleasure to greet you in the section to which belongs the distinction of having been selected by the first settlers to these United States. I have the pleasure to welcome you to the city and county to which belong the honor of having been settled by that moral, sober, industrious, and just people, called the Palatines, who arrived on this long strip of land bounded on the north and south by a strip of shining river in the year 1709, and founded this city, which was called by de Graffenreid, New Berne, after the Swiss capital in the far-away Alps. Houses were built, streets laid off, and the field cleared and prosperity came. Warehouses were opened and ships from many ports anchored in the harbor of the two rivers, and so trade and commerce joined hands with agriculture to lift the little town to wealth and importance; and so toward the middle of the century, we find the Royal Governors making this their capital and here convening their legislatures. It was not perhaps until the days of Tryon that Newbern reached the zenith of social importance such as colonial Newbern. She has given to the State some of its most distinguished builders and defenders; many of the names known in the annals of the nation were first household words in Newbern; Craven on her doorplate and later on the marble slabs under the moss-draped elms in that portion of her domain called "God's Acre." Here are still some of the mementoes and landmarks of those lost colonial days. Here is that unburned wing of Tryon's palace which links us to the past. Here is Pollock street, perpetuating the memory of him who took up de Graffenreid's work. And here are some of the residences erected by the men of that lost time. Here is the Gaston Place, Nash Place and many others that have withstood the ravages of time and assaults of war.

The Newbern of to-day is a greater Newbern. It offers every advantage of factory, finance, electricity, health and happiness that is found within the borders of our State. Her progressive citizenship has forced her to the notice of the commercial world. I might dwell at length upon the magnificent strides of this town, were you not present to view with us these many evidences of progress.

Gentlemen, we want you to feel at liberty to take for your comfort everything in sight that is eatable or drinkable, and if there is anything you want which you do not see, ask and it shall be given you.

I take pleasure in introducing you to the good people of Craven County, and in their names and in the name of the Mayor of this city, extend to you a heartfelt welcome to this hospitable and historic city.

The Chairman responded briefly to the kind address of welcome and then called upon Congressman John H. Small to address the convention, stating that the convention owed as much to Congressman Small as any other person on account of his untiring efforts in behalf of drainage.

Mr. John H. Small, Congressman from the First District, spoke as follows:

ADDRESS BY CONGRESSMAN JOHN H. SMALL.

Mr. Chairman and Gentlemen:

I am not called upon to respond to the very cordial address of welcome made by our distinguished young friend, Mr. Allen, but I cannot refrain from giving attention to one feature of the welcome which he extended, and that is that we are to partake of all that is drinkable in the City of Newbern. I have heard the story of Tantalus, who was condemned to stand in water up to his mouth with never the privilege of drinking a drop, the waters receding whenever he attempted to do so, but that was not equal to the proposition suggested by Mr. Allen when he invited us to drink in a dry town. If he had had in his mind simply the presence of water, then we would have understood him, because on this occasion at least there is water, water everywhere, and also many drops to drink.

I cannot justify, gentlemen, the compliment which has been paid me by being placed upon the program to speak at this notable convention, but the importance and the appropriateness of this convention will justify the efforts of any citizen in North Carolina to help make its deliberations a success. I feel that these people of North Carolina represent the most important factor among its resources, and that which will count more for its development, the soil. There are men from these large number of counties who are willing to leave their business and their homes and come to this good city for the purpose of lending their aid and their ability and their judgment and their means toward the solution of what we must all regard as one of the vital problems of North Carolina, the drainage of our lands.

Twenty-five years ago, perhaps that is the correct period to which to recur, the swamp lands of eastern North Carolina were regarded as practically valueless. In those times the average man did not care to own such lands. About that time timber came into demand, a value was created for it, and then these swamp lands were regarded as having some value, by reason of the forest growth upon them, and so it continued, until by reason of this demand individual landowners parted with their holdings, primarily on the part of the purchasers for the purpose of getting the timber, and the owners, so anxious were they to get something of value for those lands which they had held for so long without any profit, were frequently willing to include the land itself as a matter of inducement to those who wished to buy the timber. Speaking for myself, it is something of a revelation which has come to me to realize that these lands have an intrinsic value of their own and constitute our most valuable lands. I simply had a hazy idea that perhaps in some mysterious manner these lands might sometime be drained, but there was no definite assurance that it could be accomplished. Those of us who have given some study to the question, and that constitutes many intelligent citizens of North Carolina, have learned that those lands may be reclaimed and that they may be changed from practically valueless lands into the most valuable areas in North Carolina. A report has recently been made by a gentleman connected with the U. S. Department of Agriculture, and who occupies the position of drainage engineer in that Department, and about which I shall have the pleasure of saying a word. He has characterized these lands as being as fertile as the lands in the Mississippi delta, and that all that is required in order to make them of such value and increase their productivity so that they shall rival the most fertile lands in the world, is to lower the level of the water by a system of drainage, so that these swamp lands of ours in North Carolina, a heritage which has come down to us in the early years of the 20th century, shall turn out to be, if this meeting shall be successful, as I believe it will be, as fertile as any lands which have been reclaimed in the past.

Not only do the unreclaimed swamp lands of eastern North Carolina involve the problem of drainage, but the lands which we have improved, which were cleared and put to the plow years ago, also require drainage to the same extent in order to make them profitable for cultivation.

Mr. Chairman, I have personal knowledge of one county in eastern North Carolina, one of the most fertile and prosperous counties in the State, the county of Hyde, whose lands for one hundred years or more have produced abundant crops, and which are famous beyond the limits of the State, until she came to be called the granary of North Carolina. For three years, including this, they have had failures of crops there by reason of the lack of drainage of their lands. Those areas that have heretofore been regarded as so extremely valuable, so that they could not have been bought during the last one hundred years for $100 an acre, are valueless during such years as the past three. What a misfortune it is that fertile lands in a county possessing men and women of intelligence and culture, a county where there is as little provincialism as in any agricultural county in North Carolina, should suffer under such conditions. How must such a state of affairs in a section like that appeal not only to landowners in that county, but to the civic spirit of every citizen of North Carolina to reclaim their lands and bring them back to their original productivity, if it can be accomplished. Unfortunately, however, that county is simply typical of others. There are other counties

I doubt not in eastern North Carolina in which the conditions are possibly not so acute, and yet their experience during the past three years has been so disastrous as to demand some remedy by which their lands may be drained and their productiveness restored.

Not only, gentlemen, is it a question of our swamp lands and our improved lands in eastern North Carolina, but there are fertile river bottoms in the territory just west of us and in the Piedmont section, heretofore noted for their fertility, which during recent years have been inundated by floods, and they are equally interested in this question of preserving their lands from overflow so that their productiveness shall be maintained.

These are some of the problems, gentlemen, which confront the people of North Carolina. I mention the river bottoms in the upper sections of the State for the purpose of illustrating that this problem is not peculiar to eastern North Carolina, but that it concerns the whole of the State.

What is the remedy, gentlemen, for this condition? I stated a little while ago that this question of drainage was formerly regarded by me as impracticable. I have now reached the conclusion that it is entirely practicable to reclaim the greater part of our waste swamp lands and that it is absolutely practicable to drain every acre of these lands which have been improved and reduced to cultivation. It is a practical problem and it may be solved. How may it be solved? Drainage has two characteristics. It confers two kinds of benefits. One benefit is to the owner of the land by the increase in its productive capacity and thereby increasing its actual value. That is the private benefit. There is another class of benefits, and among them may be counted the improvement in the public health, and improvement in the highways, and the improvement and promotion in the general welfare of the country. These are public benefits. The distinction between these and the necessary relation which they bear one to another may be pointed out briefly in just a few minutes.

How may our lands be drained? Unfortunately in North Carolina in the past each landowner with his individual tract of land has endeavored to drain his land himself without reference to his neighbors. That cannot be done. The only successful method by which land may be drained is to include in one area or drainage district all of the lands which have a common outlet, and to carry the water from all these lands into the common outlet. With one or more large lateral branches or canals leading nto it from all the lands in the district, the large area may be drained. t is impossible for one individual to effect such a purpose. A man may wn a tract of land and the outlet may be three or four or five or ten miles distant. If he attempts to cut the proper canal from his land it must go through other lands. It is impossible for the landowner to do this within reasonable cost. Therefore, it is impracticable from a pecuniary standpoint. On the other hand, even if he had the means, he is draining the lands of ten, fifteen or twenty-five landowners between his land and the common outlet. Should this landowner be compelled out of his own pocket to bear the cost of the drainage of the lands below, and they not contribute to the expense? Hence you have two difficulties, the very difficulties which are confronting thousands of landowners in eastern North Carolina. How is that problem to be met? It is the same old story of the necessity of co-operation one with another. These contiguous landowners must get together. By that spirit they will furnish the means and drain all of the lands situated within these drainage areas and having a common outlet, and thereby the result will be accomplished and the water level will be lowered to a sufficient depth so that they may look for reliable crops on their farms.

May I philosophize upon this point? I wish to say that the lack of this spirit of co-operation is one of the civic defects of our people. There is not sufficient co-operation one with another in order to accomplish public benefits and bring about results. It is not peculiar to any particular section, but, in my judgment it is a common defect of us all. Some of the best things in life, those which make for the progress and uplift of humanity can only be accomplished by this spirit of co-operation. Let me mention a few. One of the most important problems for solution in North Carolina are improved highways. We have illustrations in many sections of the State and in some of the eastern counties particularly, where we have no better highways than we had many years ago, and during all these years they have been a disgrace to the people. We will not have better highways until we unite together and by dividing the burden among us do whatever may be required to make better highways.

We have heard much during these last few years about the illiteracy which prevails among the white people in North Carolina, and we have heard that the only way by which all the children may be educated is by the public schools supported by local tax, and this may only be accomplished by this spirit of co-operation. You find a community which seems to be progressive, and you ask the reason, and the most usual reply is that the people are public spirited, and that expression translated simply means that there are a number of men and women in that community who are willing to unite one with another and bring about these public improvements which make for progress.

I shall not detain you longer by philosophizing upon this question. But I repeat and I repeat with emphasis, and I will be able to demonstrate to you in one moment, that only by this spirit of co-operation can we drain these bodies of wet lands in North Carolina. Unfortunately, however, in this world of ours, we can never expect to have absolute unity. We may have in a drainage area or district twenty-five landowners. It will be a very remarkable condition when all of these landowners are willing to unite with each other and contribute their share to the burden in draining this land in such drainage district. How are you going to drain your lands against the objections of the few? Shall the project be stopped? Shall A. who owns a farm which only needs drainage to promote its productiveness be prevented from draining his lands because B., C. and D. will not join with him? That is the problem that has confronted us in the past. We must solve that problem if we shall successfully drain these lands. How can it be done? Under our Constitution and the laws you cannot cross a man's land, you cannot compel a man to go into his pocket and pay taxes for the benefit of A., who owns a farm here. You can only cross his land or tax his property because of the public benefit which results from this drainage; because the public health will be promoted; because we cannot have good highways without draining these lands; and because the public welfare will be promoted by this drainage.

The outside world believes that eastern North Carolina is unhealthy. There are some ignorant folks living west of Raleigh who yet think that it is unsafe to come to eastern North Carolina. We do have some malaria down here, and I have never yet found a place where it did not exist. I thought I found a place once in Massachusetts exempt from malaria, but I was mistaken. Upon this question of healthfulness in eastern North Carolina, we know that it is a problem easy of solution, for with good water, with drained lands and with screened houses I could live, and you could live in any swamp in eastern North Carolina with just as much security from malaria and disease as you could upon the top of Mt. Mitchell.

So this question of drainage bears direct relation to the promotion of public health. I may say that whenever we drain these lands and when we get good water, as we may get anywhere in eastern North Carolina by deep wells, then we may go into the great States of the Mississippi valley where there are thousands of families who wish to change their location and invite them to settle on our rich lands and participate in our prosperity.

By reason, gentlemen, if you please, of the public benefits resulting from drainage, the Legislature may confer upon an association, or drainage district the right to compel each landowner within such drainage district to join with the other landowners and contribute to the expense of draining all the lands within the district. They may say you shall contribute your share of the burden, and it is upon this basis that it has been found practicable to drain our swamp lands.

One of the purposes of this meeting is first to focus the attention of the people of North Carolina upon this question of drainage, and to let it go forth as a distinct declaration of these gentlemen who are gathered here, that it is absolutely practicable to drain these lands. Our next object should be to frame a law and submit it to the Legislature which will make it possible to organize these drainage districts whereby our lands may be successfully drained. We have a drainage law, but it is entirely inadequate. We need a modern drainage law, and this convention ought to set on foot a movement which will result in the enactment of a proper law. Others have had this problem presented to them just as we have had it presented to us, and have solved it. We should frame a law which shall be submitted to the next Legislature with the request that it be enacted into a law. I believe, gentlemen, that this meeting will be successful in both of these purposes.

I cannot take my seat, gentlemen, without referring to two men who have been conspicuous in this movement. Last year there came into North Carolina a gentleman from the U. S. Department of Agriculture, who occupies the position of Supervising Drainage Engineer in that Department. If he desires he may close his ears for a moment now. He is present with us. He is one of the foremost drainage engineers of the United States. He has had experience in the States of Missouri, Illinois, Indiana, and Iowa. He has also had years of experience in the State of Louisiana, where they have solved the question of drainage under conditions much more difficult and expensive than any which confront us, and with his skill and experience he saw these lands in eastern North Carolina, saw how crops were cut off in 1907, as they had been in 1906 in some of our counties, and he became interested and resolved to study this problem of drainage in our section of the State. I have had my admiration excited by his zeal and his disposition to serve our people. That is particularly noteworthy, because the average official living in the City of Washington soon learns to love his seat in the office better than anything outside. Mr. Wright has made a number of trips down here. He has been with us this summer, and I know of no man who has contributed so much to initiate this movement as Mr. J. O. Wright of the City of Washington. We all owe him a debt of gratitude. He had the great fortune some years ago (I will not say how many), to be born in the County of

Guilford, and when a boy his parents moved to the State of Indiana. It has given me great pleasure to pay this tribute to this unselfish, zealous, public-spirited man who has contributed to a movement which means so much to the welfare of North Carolina.

I wish to say just one thing more due another gentleman. In the early days of this movement there accompanied Mr. Wright in his visits through eastern North Carolina a gentleman who is at the head of our State Geological and Economic Survey. You know that the Legislature in 1905 widened the work of our State Geological Survey so that it includes not only subjects relating to geology, but drainage, public roads, fisheries, and perhaps one or two other subjects, which I do not now recall. Almost from the very beginning Dr. Joseph Hyde Pratt, our State Geologist, has been unceasing in his efforts to secure information and to promote this movement which is taking shape to-day. He is entitled to conspicuous mention and to the gratitude of the people of North Carolina.

I have detained you longer than I anticipated with this rambling talk which I have made to you. I am glad to be one of you and to work with you, not as leader, because I am not entitled to that distinction, but as one in the ranks to contribute my share in whatever way may lay in my power to foster this great movement, which means so much to the progress of North Carolina.

I was particularly desirous of impressing upon you a few basic propositions. I submit that the problem of drainage is a public question and confers a public benefit. That thereby drainage districts may be formed, and lands taken and taxes imposed for the purpose of paying the bonds and other expenses incurred in executing the plan of drainage. That it is necessary for the Legislature to enact a modern drainage law. That our people must be educated up to the importance of drainage, and to a knowledge of how the same may be accomplished. That it is necessary to inculcate the spirit of unity and co-operation, in order to give effect to the law and to secure the best results. That the result of this drainage movement, if carried forward successfully, will be to add a large area of fertile lands which will attract settlers from other States and make greatly for progress and prosperity.

In introducing the next speaker, Mr. J. O. Wright, Drainage Engineer of the U. S. Department of Agriculture, the chairman referred to him as the leader of the drainage work in the South and one who has already been of very great assistance to North Carolina in the investigation of her drainage problems.

How to Drain Our Swamp Lands.

BY J. O. WRIGHT, DRAINAGE ENGINEER.

The value of any kind of property depends upon the amount of money that it will return to its owner. Railroad stocks depend upon the amount of interest you get from them. The value of property depends upon the certainty of getting a return and the amount of this return. That is true of all kinds of property and it is particularly true of agricultural property. If you go to any country and find a farm that is producing a good crop every year, that farm is worth a great deal of money; and much more than a farm in the same vicinity that will produce only a poor crop when the season happens to be right; for the owner of the latter farm does not know when he plants his property whether he will get any return or not. If you have a piece of property that brings no revenue, it is necessarily not in demand and has very little value. Now, property may have a speculative or prospective value. For instance, if it was announced that the railroad company was going to put up a large shop at Newbern and employ a large number of men and build cars, property for miles around would begin to go up in value right away. The land would not be worth any more, but would have a prospective value, depending upon something happening. If the shops should be built, the men might realize that value.

I find that there is in eastern North Carolina about three million acres of land that is classed as overflow lands, and is made up of a soft marsh. Then there is a larger area of land that is overflowed practically all the year round called swamps. There is still another body of land lying a little higher than the swamps that is in cultivation, which sometimes produces a crop and sometimes not. In Hyde County, as Mr. Small mentioned, the crops have for three years been almost a complete failure. There have been times when they had good crops, but it depends upon the dryness of the season and, therefore, the land does not have the certainty of producing a crop each year that is necessary to make the land of great value. I have been over there this year and I found on the high ground good crops, but on the low grounds that are more fertile there were no crops at all. Thus, you are farming in eastern North Carolina land that is productive some years and some years it is not. You have in eastern North Carolina very rich overflowed and bottom lands that are liable to overflow from the river and by back water from the swamps. If you have an excessive amount of rain, the crops are a failure and this is the condition that I have found in eastern North Carolina during the last two or three years. These lands that I have described have not a great deal of real value. The soft marsh is absolutely worthless, unless timbered, and the swamp land has no real value, unless it is also timbered. There is no loss in swamp lands, but there is a great loss in cultivated lands. If a man goes to the trouble of ploughing his land and planting his seed and then gets no return, he has lost his time and his seed and often he has lost heart. The next year he does not know whether he will succeed and does not go at his work with as much vim and energy. I have had men to tell me in eastern North Carolina that they have lands that are not as productive as they were a number of years ago—that conditions are getting worse. The land is not worth as much now as it was twenty-five, fifty or sixty years ago. The owners of these lands have before them, if they could realize it, a very rich inheritance. You have kept these lands a long time, and outside of the timber you have sold you have received no revenue.

I take it that the people who have come to this convention are interested in drainage. Congressman Small has detailed some of the difficulties which confront you. I am here to tell you how you can overcome these difficulties. I know how it has been done in other places and what other people have done you can do. When I left North Carolina in 1868, I went to Indiana. I had letters from friends there telling me what wonderful opportunities were there for young men. I went out there and found the country was sparsely settled. Large tracts of land were put into cultivation, some of which at that time was worth from $25 to $30 and $40 an acre, but the greater portion of the land was only worth from $5 to $15 per acre. The northern part of the State was prairie land with no trees whatever on it. The section where I located was composed mostly of timber lands. It was three and a half miles to the postoffice, part of the way across a swamp known in those days as "hog pool sloughs." In order to pass at any time of the year a corduroy road was made for half a mile, but it was not possible to get through the swamp more than half the year, and it was an extra three miles around the swamp. It was impossible to build a road through it. That was the condition of that country at the time I mention. The people raised more or less corn on these lands, but when they would gather it, it was soft corn. It was so wet in the spring that you could not plant corn at the proper time. To overcome this, one man introduced a corn that would mature in ninety days. You could get from sixty to seventy bushels of corn to the acre, but it was the quality that it lacked. You could grow some wheat and a little oats. Now you can go to that country and find it laid out in sections, with well-improved hard roads, many surfaced with stone. You will find the sloughs or swamps have all been drained and that a great many of the farms have been tile drained; you will find the people prosperous, and if you ask the value of farm lands, they will tell you $120 to $125 an acre. The whole solution of their problem was drainage; they drained their lands and were thus enabled to grow large and good crops. Land in Indiana to-day would not have been worth any more, or very little more than it was when I went there, if it had not been drained.

There is nothing particularly difficult about drainage; but it takes time and it takes money. The soil out there is not any better than your soil here in eastern North Carolina and the climate is not so good. A bushel of corn is worth ten or eight cents more in North Carolina than out there. They cannot raise the vegetables and potatoes that you can here in eastern North Carolina; and I cannot see why the conditions here are not superior in every way to the conditions I found in Indiana when I went there. You have the soil and you have the climate; in fact, you have everything that goes to make up a magnificent country but drainage, and why not have drainage? After living in Indiana for a few years I became a civil and drainage engineer and started out giving my whole time to drainage. My business called me a little further west into Illinois where I found prairie lands and conditions very similar to those in Indiana. I don't usually like to read what other people have said, but I want to read from a paper by the State Drainage Engineer given in the report of the last annual meeting of the Iowa Drainage Association:

> Before drainage districts were organized and the general drainage of the country accomplished, all the central portion of Illinois, which is now the most fertile and highest priced land in the State, consisted of successions of low ridges and shallow depressions varying from a few rods to a mile or more in width. The depressions during the spring and summer months, the planting and growing seasons—being either lakes or swamps impassable and of no value to the owner and a source of malaria and ill health to the inhabitants. Every county in this whole section of the State had large tracts of land which the government could not sell and which were donated to the county as "swamp lands,' the proceeds of the sale of such lands to be used for the drainage thereof.
>
> Upon the enactment of practical drainage laws, the farmers proceeded to the organization of drainage districts, both large and small, for the construction of open ditches and for the construction of tile ditches, and they have drained a large portion of the area of the wet lands of Illinois and have reduced the swamps and ponds and sloughs to fertile fields on which abundant crops of corn, oats and wheat and grass are raised from year to year. Public highways have been laid out at frequent intervals and are usable at all seasons of the year, notwithstanding improvements known as hard roads would be of great benefit in many localities. The value of the products of the farms has increased from five- to ten-fold over the old conditions and the value of the lands themselves have increased from their former prices of $5.00 to $25.00 per acre, until practically all well-drained lands in central Illinois to-day are

worth on an average of $150.00 per acre. Without the benefit which accrued from drainage, these lands would be as worthless and probably lower priced to-day than they were twenty-five years ago.

I simply read that to corroborate what I have said about Indiana. I know this from my own personal experience and I am satisfied that if this same method was employed in eastern North Carolina that has been employed in Indiana, Illinois and Iowa and other States that I could name, that the same results would be just as sure to follow. We have the same conditions here, and if you apply the methods you are bound to obtain the same results. You will increase the productive power of the land and, still better, you will bring into cultivation a great deal of land that now is absolutely worthless for agricultural purposes. You will also increase the actual selling price of the land a great many fold. You ask how this work was done? That is my business here, to tell you how this was done and how you can do the same thing here. In 1879 Illinois passed a State Drainage Law. Now, what I mean by a State Drainage Law is a law enabling the people in a locality to get together and drain a definite area of land. As you know, in this country we believe in the majority ruling and it is not possible to carry out a law until the majority of the people are in favor of it. So it is with a drainage law. It is possible to have a drainage law, if the people are in favor of it. The drainage law by itself will not drain your lands. You may have the same law that they have in Illinois or in Iowa and it will not drain your lands until there is a public sentiment behind it. If in a community there is one man in favor of drainage and everybody else opposing it, it would not be a wise thing for that man to try to carry on drainage. The Illinois law provides that when a certain number of people owning land within a given territory petition the court setting forth that a certain territory is wet and overflowed and ask that this land be drained, the court will appoint an engineer and two men as viewers to look over this territory and report back to the court. These people go out and look the territory over and report to the court, and if the court finds that the drainage of said territory is practicable and that the work will benefit the public in any way, it orders the drainage district established. As you see, it simply requires the writing of a petition and filing it before the court, the Superior Court or your County Commissioners; the appointing of an engineer and viewers to go out and examine the territory and come back and report to the court or County Commissioners whether it is conducive to public benefit and if so, establish that territory into a drainage district, and the district becomes a corporation. That district is bounded by certain defined lines and nobody outside of those lines is affected.

The next step: You cannot take a man's property or cause him to incur any expense without his having notice and, therefore, when this petition is reported to the court, they cause notice to be given that on a certain day this report of the engineers and viewers will be heard and considered, and the people can come from all over the district. They can take this report and examine it and see if it is right. If they think there is some land still out that should be brought in, they can say so. They can also say if they think there should be another district. If they think there is some land that would not be benefited that should be excluded, this can be taken up and thus, after everybody is satisfied, nobody hurt, no expense incurred, for you have had to pay out no money, the court then appoints the engineer and viewers to make a survey. This first report is called the preliminary report. The engineer runs the lines and figures out the bounds of the ditches; he makes such changes as he thinks best, and he figures out the number of cubic yards that should be in each ditch. He makes a map showing the lines of everybody in that district and how many acres each has. Two men go with him and they classify that land. They say which will be most benefited and how it will be benefited. They classify the land according to the benefit, as some land will be benefited more than others, and the cost of this work is to be paid by the landowner in proportion to the amount it will be benefited, and the land that receives the greatest benefit bears the greatest burden. So, after the engineer and viewers have completed their labors, they make another report. They have the land classified, the ditches laid out and the cost figures.

Mr. Small: The report of the engineer and viewers does not specify that John Smith shall pay so much, but it gives the number of acres he has in Class A, B or C, and the court makes the calculation and applies the rule of law, depending upon how much is necessary in proportion to the number of acres in each class.

Mr. Wright: That is the right idea. The land that is benefited most is put in class A and the next in class B, and you may have four or five or six classes, and also have the number of acres in each class. This is the plan to be put before the people. They are notified that on a certain day they will hear a complete report of the engineer and viewers. It is put on file in the office of the clerk for a number of days where any one can examine it and see how many acres are in each class and whether your land is in the right class or wrong class. You have full opportunity of offering all kinds of suggestions and objections and these are heard by the court. After the objections are heard and changes made to the satisfaction of the landowners of the district, the court then confirms the report.

Thus far, you have not been asked to put up any money or do anything unreasonable. I believe you have an appraiser that goes around and assesses your property for taxation and then you have a report when you can come in and equalize them. You say, I am assessed too much on this property, and then it is decided what is just and right and you pay your taxes on that property at that assessment. That is exactly what we do in a drainage district. We get the number of acres of land and get the land classified according to the benefit it will receive.

Now the next step: If a man has got low swamp lands and no other means of making money, he cannot put up a ditch tax, and there is a ditch tax placed on every acre benefited. This man has no other income and it is pretty nearly the condition in the average drainage district. A great many people have swamp lands but little else. I say, there is no use in asking a man to pay a great sum for getting drainage when he has nothing but wet lands. He cannot do it. The people of Illinois could not do it. At first they divided the area to be ditched and each man was to come and cut out a small ditch. What happened? It was never done. After a while they found that kind of procedure would not work. Somebody conceived the idea that they would issue bonds for the drainage of the lands. First, they said the bonds would not sell, but the law provided that they might issue bonds bearing 6 per cent interest, and they should not be sold at less than par. They all sold and they never sold at any less than par, and at the present time they are at a slight premium. You take no risk; they are just as good as any bond on the market. The next step after the sale of the bonds is to contract the digging of the ditches. To do this kind of work it is necessary that it be done in large contracts and with improved machinery. You cannot dig them with a shovel. There are now many men known as drainage contractors who take these contracts at so much per mile. The bonds having been sold, the money is ready for the contractors as they complete their work and as yet no one in the drainage district has been called upon to pay any money. These bonds, however, have to be paid somehow. To my mind, it is best to have the first bond due in three years, then one bond to be paid every year thereafter for nine years, making ten years. At the end of the third year you have got to pay one-tenth of your ditch assessment. The cost has been assessed on these lands and you have got to pay one-tenth of that the third year. Suppose it cost $4.00 per acre on a piece of drained swamp land. You pay one-tenth of that which is forty cents an acre at the end of the third year. Your ditches have been dug and you have got your lands drained, but now you are asked to come in and pay forty cents according to contract. Where is the man going to get the forty cents an acre? If he cultivates that land that has been drained, he can raise corn enough on it to pay the tax on 100 acres. So the money you pay for this drainage comes off the land that has been drained. The next year you raise another crop and put more land into cultivation. It comes easier to pay the second installment than it did to pay the first, and before the ten years expires you are making enormous crops and you pay your drainage tax at forty cents an acre, and have a good balance to put in the bank. That is the way this work was and is still being done in the western States, but when it was first proposed out there, you never heard so much opposition. I have never yet heard of a piece of land that had to be sold to pay the ditch tax. I have never known of any hardships being imposed on any one because of an arrangement of this kind. I have been on the ground when the contract was let and when the work was completed, and I have known land to go from five to thirty dollars an acre on the strength of what was being done, and when the drainage was completed, it would stand at that value. I cannot see why the people of North Carolina in an arrangement of this kind would not be able to go ahead and drain their land and derive similar benefits. You cannot drain it all in one year, and it may take five, ten, fifteen or even twenty years, but whenever the land is drained, it will increase in value. Do you know of any large place now that will produce a good crop every year that can be bought for ten or fifteen dollars an acre? What is the price of that land? You could not buy it, and if you did, you would have to pay a good price for it. I want to tell you if you drain these lands, there is no reason why your lands will not increase in value. I don't know of any place where there is good, well-drained land lying idle. I travel a good deal and I don't know of any good agricultural land that is drained and will produce good crops every year that can be bought for less than $75 to $150 per acre. What obstacle is there that you cannot overcome? Can you get your Legislature to pass a drainage law? I think you can. If you have the drainage law, one man can write a petition and take it around and get some of his neighbors to sign it. It would take a few hours of his time but not a dollar of money. Then, let your contractor do the work and pay for it out of the money that you can get for sale of lands.

Now, as I say, the steps are these: First, the people have got to realize their condition and make up their minds that they want to better it. You have got to ask your Legislature to enact this drainage law and when you get it, you have then got to get behind it and put it into execution. It is a problem that one man cannot do. It is a problem that is best done by a community, but it is not a difficult problem. I could stand here all the afternoon and cite instances showing you the great benefits that have accrued to various localities from the drainage of swamp lands, but it is not necessary. You may have some lands that you cannot readily drain. Take the lands that you can easily drain and drain them first.

The drainage tax is collected in the same manner as State and county taxes. When the land that is drained is worth ten, fifteen, twenty, or twenty-five dollars an acre, no man is going to stand in the way of paying the assessment. I have yet to find the first instance in which land is sold to pay the tax, unless in one or two cases of some lands belonging to non-residents, and they allowed the land to be sold and afterwards came along and redeemed it. The land is responsible. The tax is levied on the individual landowner, but it is against the land and not against the person.

It is assumed that no court would establish a drainage district if the cost of the work is going to be more than the profits derived from it; so when the benefits are so far above the cost, the land is absolutely good for it, and if the tax is not paid when due, it is up to the officer to collect it. The first payment can be made due at the end of the first year or the third year or fifth year. Different States have different times. It is my idea to have the first payment due at the end of the third year. The bonds carry with them a rate of interest payable annually or semi-annually, as the bonds may be drawn. During the first three years there can be sufficient tax levied to pay the interest alone. In some instances the court before whom this proceeding is held is authorized to go to some local bank or some person and borrow sufficient money to pay the preliminary expenses to the engineer and viewers, and pay the interest at such time as you can make it become due. That is anticipating a revenue. Land that is sold for tax is usually put up and bid in for just what the tax is.

QUESTION BY DELEGATE: Did you ever know a tract of land sold that failed to bring the amount of the tax?

MR. WRIGHT: I do not recall a single instance where land has been sold for taxes. In the early laws of Indiana, they required that the tax be paid cash down. I cannot recall a single instance in which I have known land to be sold.

MR. SMALL: A great many of our people believe that large areas in this coastal plain cannot be drained because the fall is not sufficient. Please express your judgment about how much fall there should be per mile.

MR. WRIGHT: That is practically an engineering question, and each case would have to be determined for itself; but I do not believe that you have any land in North Carolina, except some lands that are near the coast, that has not sufficient fall for drainage. I have been in a great many places in which it was thought that there was no fall, but when the engineer examined it he found that there was considerable fall.

QUESTION BY DELEGATE: In connection with that, take a year like this, would drainage do much good in this locality or section?

MR. WRIGHT: This is just the kind of weather that you need it.

MR. SMALL: You mean to say that in your opinion that in the great bulk of our swamp lands that in years like the last two or three, if this system could be put into execution, that the lands could be drained?

MR. WRIGHT: Yes.

At the close of the discussion of Mr. Wright's address, the chairman appointed the following committees:

Committee on Legislation.—John H. Small, Chairman, J. O. Wright, E. W. Myers, A. D. Ward, A. B. Lukens, F. M. Simmons, C. R. Thomas, E. M. Green and E. P. Carter.

Committee on Resolutions.—John A. Wilkinson, Chairman, R. O. Bagley, E. W. Myers, W. G. Ferebee, C. R. Vandecarr, P. H. Morgan, D. M. Patrick and W. W. Ashe.

The next speaker was Senator F. M. Simmons, who spoke as follows:

ADDRESS BY SENATOR F. M. SIMMONS.

When the Chairman very kindly extended to me an invitation to address this convention, I replied to him saying that while I would be delighted to make a general speech, I did not desire to be put down for the purpose of making a set speech. I prefer rather to come to this meeting with a view to gain information rather than with a view of attempting to impart information. I shall, therefore, in what I have to say this evening, eschew altogether technical phases of this great and very interesting question that we have met here to discuss, because there are experts who have offered their services to enlighten this meeting, who surely know more about this question than I do and who surely can discuss them with much more intelligence than I can.

Mr. Small and Mr. Wright this morning discussed ably and exhaustively certain lines of thought relating to this subject which I had expected to discuss. If I were to attempt to travel over the same field, it would merely be a duplication or enlargement of their thought and I shall not weary the convention to do that. They have discussed the relation of the State, of the locality and of the citizen to this question of the drainage of swamp lands and uplands adjacent to swamps and affected by the overflow of swamps. I do not think anything could be added to what they have said upon that line. Others are going to discuss some of the technical phases. For instance, Dr. Duffy is down to discuss the relation of this subject to sanitation.

There is another aspect of the question, however, thus far not presented by any delegate and not to be presented so far as the program indicates by speakers to follow me, upon which I think I might properly, for a short time, ask the attention of the convention, and that is the relation of the general Government to this subject. That is an especially interesting phase of the matter to me, because that is a feature of the drainage problem upon which I have reflected and upon which I have made some slight investigation.

The Duty of the Government.—The probability of the Government's lending its aid to the citizens, to the community, and to the State, to drain these swamp lands in the same way that it is to-day lending its aid to the States and the private citizens in the great deserts of the West to reclaim and to bring into proper cultivation the arid lands of those regions, is a very big and is becoming a very acute and pressing question throughout the country to-day. There are vast areas here in the South, here in North Carolina, hundreds of acres in separate tracts, ten thousand acres in other tracts, large areas either the subject of State ownership or private ownership not yet segregated into farms, which form, in my judgment, the basis of any thorough, complete and effective drainage of the wet lands of the South. When they are drained, when there are great canals wide enough and deep enough to float ocean-going vessels, running into these immense areas, taking the water out of them and leaving them high and dry land, then the problem of drainage upon the banks and in the adjacent territory will be a simple matter. How are we going to drain these vast areas? It has got to be done either by aid from the State or Federal Government.

I must now ask your attention for a few minutes to a discussion of the relation and the duty, according to my mind, of the Federal Government to this very important and interesting question.

In order that I may present my ideas with some degree of clearness so that I may get you to see this as it appears to me, let me go back a little.

When you consider the duty of the nation, you want to consider what the nation is, and it is nothing in the world but an aggregation of people. The citizen is the unit, the nation is the whole. Now the problems of the citizen and the problems of the nation are very much the same. They must be worked out on very nearly the same lines. Where the citizen, by reason of his limitation of means, or by reason of the restraints of the law, cannot work out the problem, then it becomes the duty of the State, which represents all citizenship, to work it out for him, provided it may be done within constitutional and legal limitations. The problems confronting each are very much the same, and the problems change whether they be problems of the citizen or the State.

First, consider our country. How rapidly its problems have changed! We sometimes feel that this is an old country of ours, and yet, my friends, while it is old as we measure the span of a man's life, but, when we compare it with the great nations of Europe, it is a mere lad among the nations. We have been in existence as a nation less than one hundred and fifty years. In that time, how rapidly have the problems of the nation evolved!

In the first era the great problems which vexed the minds of patriots and statesmen were the questions connected with the security of life, liberty and property. The first era of our country was taken up with the discussion and the settlement of those fundamental questions. They were all settled wisely and well, in my judgment, with one exception, and that exception was the attempt on the part of our forefathers to link slavery and freedom and out of that exception grew the problems which absorbed the public thought of the nation during the middle era of our history, and which was not settled until the close of the Civil War.

After the war, our national problems became purely economic and industrial, and these are the problems with which we are dealing to-day.

It has been said that there never comes, in the life of a nation, a demand for a great man, a man of certain qualities and certain attributes, but that man is not raised up; and whenever the time comes for the settlement of a great problem, when that problem can no longer be put off, it presses itself upon every man, situation and condition in life, until it forces action. People do not appreciate a want until it becomes difficult to satisfy, or until the satisfaction of that want becomes impossible or unattainable.

Now, just so long in this country as we had vast areas of unoccupied lands available for farms and had great reaches of untouched timber, we thought that our supply of farm land and timber was inexhaustible, and yet, my friends, with only forty years of industrial activity, for our industrial activity really began at the close of the war, the available farms that could be purchased at a cheap price have been exhausted. I know that you can buy all the lands that you want if you pay the price, but what the Government demands for its citizens, what this new country of ours demands for the home builders is not high-priced land; and as long as it is possible within the limits of proper efforts to secure it, it is the duty of the Government to furnish cheap homes for the settler. The time is rapidly coming in this southern country of ours when the poor man, with the cares of a growing family upon him, must drudge for years before he can secure a home, and yet there is in the South millions and millions of acres, areas that constitute an empire greater than Great Britain and Ireland, greater than the New England States with New York added, which, with a little expenditure, can be thrown open to the home settler and be made into happy and prosperous homes.

Now the same is true with reference to our timber. We thought that we had inexhaustible supplies of timber, that is, if we thought fifteen or twenty years ago about the matter at all. We had so much that the idea that it would ever be exhausted never occurred to anybody and it is only as we see it vanishing and see the time approaching when this will be a treeless country that we think about the limits of our supply. We are to-day in North Carolina cutting timber at a rate four times greater than God is making timber. Now, without any irreverence, it may be said that God is not making any more land. He is making more people, they are multiplying in the United States at a prodigious rate. When the war closed, forty millions would have more than covered our population; to-day twice that number will not cover it, but in that period of time no acres have been added to our domain, except those that we have purchased by conquest or with money across the seas. That condition remains unchanged.

Now, my friends, unless our activities as people are to be restrained or are to be arrested altogether, we have got to extend and conserve the materials which furnish the basis of our industries. If you want more farmers, you have got to supply them with the land. If you want to keep up your industries of which timber furnishes the basis, you have got to get the timber. You cannot make more lands, but you can make waste and useless lands, by the millions of acres that are now subserving no good purpose, available for farmers; and you can, by proper conservation of your forests, make them a permanent national source of wealth instead of a transient one, as will be the case, unless the present reckless waste is stopped.

Now, Mr. Chairman, I was very much interested in the discussion this morning by Mr. Wright of the plans adopted out in the States of Indiana and Illinois. I believe only a comparatively few years ago they had vast areas of swamp lands covered with water serving no good purpose for homes or agriculture. I believe, as a matter of fact, that to-day Indiana and Illinois have practically no swamp lands; all have practically been drained and within twenty years. I have read the plan outlined this morning and it is an admirable one. If our State Geologist can get the people of North Carolina to adopt and put it in operation here in eastern North Carolina, this section of the State would blossom like a rose. Mr. Chairman, the problem is now just as pressing upon us as it was upon the people of Indiana and Illinois thirty years ago, and it is just as important that we should do it. The only difference is our lack of ability and, therefore, the Government of the United States can, I think, with propriety be appealed to. Just as long as there were cheap homes in the northwest for the farmer and the home seeker, we heard no demand for irrigation of the arid lands of the West, although we did hear speculation men talk about how fertile those lands could be made if some means could be discovered by which water could be distributed upon them. There was, however, no public demand for irrigation that forced recognition on the part of Congress until all the cheap lands in the central west and northwest were taken up and lands had become so high in those sections that they could not be purchased at a reasonable price; and the tide of immigration had pushed on to the border of this dry area. There was but one way to make that land available for homes and that was to put water on it. They came to Congress; they thundered at the doors of the House and of the Senate until they made the Democratic party and the Republican party and all the parties heed them, until they made the Treasurer of the United States open the vaults of the Government and take therefrom sufficient money with which to irrigate those lands, to make them available and fit for homes; in order that the home seeker in the United States might find, not a home, because he could find that anywhere in the northwest if he had enough money to pay for it, but a cheap home, a home within the reach of the poor home seeker.

The Federal Government undertook this work because it was too big for the individual, or because the individual could not be induced to do it in time for the needs of the Government to furnish homes.

Now, as I started to say, a little while ago, we will no doubt in the end, even if the Government does not give us a single cent, drain our swamp lands here in eastern North Carolina by the plan suggested by Mr Wright; but that is not coming as quickly as I would like to see it come I want to see the State in action, giving us an ample and effective law. I want to see needs arise so that the individual is ready to take the initiative and I want to see the nation come to the relief of the State and of the citizen by loaning them money, not giving it to them; for I do not believe in the Government's giving anybody money, but loaning it to them upon such reasonable terms that they can pay it without feeling it. We are now approaching a condition in the South with reference to our swamp lands that was reached in the West with their dry lands, which ended in Congress passing laws favoring irrigation.

We have now reached the time in North Carolina when it is hard to buy land. You start to-morrow for the purpose of buying a home here in eastern North Carolina and you will find that unless you take one that is hardly worth having, you will have to pay a very high price for it, which is entirely too high for the ordinary home seeker such as I have been talking about; higher than could be paid by the immigrant such as has settled the great Northwest and made its land, in twenty years, increase from fifteen dollars and twenty-five dollars an acre, as Mr. Wright stated, to one hundred and fifty and one hundred and seventy-five dollars. Whatever may be said about certain classes of immigration, any man who will go out to the Northwest where the foreigner of the right type, the Dane, the Swede, the Norman, the Scotch and the German, have come and bought lands at cheap prices, such as we cannot give them to-day here in the South, he will abate his opposition to properly restricted and regulated immigration. Think about it, the influx of population drawn by those cheap lands, and they went further and further in order to get it, has raised lands in twenty years from twenty-five to one hundred and fifty dollars per acre!

We have got here in the South a larger area of waste lands than they have arid lands in the West, that are capable of being made productive. There are more acres that are available for farms in the South that are now under water or that are made useless because of too much water than there are dry arid acres that are capable of being made profitable for farming in the West. Think about it! Seventy-seven millions of acres of swamp and overflowed land, I believe Mr. Chairman, in the South that might be available for farming purposes! It is a vast alluvial empire, every acre of it richer than the richest of those arid lands of the West after water has been put upon them by the Government; richer (I believe I am justified in the statement) even than the lands of Indiana and Illinois, and with a better climate. The most valuable alluvial deposit upon the American continent is found right along here in this little strip of the Atlantic Seaboard, which we call the South. Seventy-seven millions of acres, a hundred thousand square miles, an empire I say in itself, and yet we find men here wanting farms. We find ourselves unable to furnish the immigrant with lands cheap enough to attract them, and yet we have this vast area of lands right at our doors richer than that which we have already cleared. We cleared in the high places; we cleared the weaker land because we could do it cheaper. The best, the most productive and the most wealth-producing still remains unused, and we ought to start at once to try, by the methods that have been outlined, to prepare this land for farms as long as the demand may grow. Nothing would do more towards turning the tide of immigration to this Southern country than the knowledge that these vast alluvial deposits were to be made available for cultivation.

Now we are, I say, in the same condition that the West was when it demanded irrigation. We need this land in the normal processes of our development as a State and as a section of this great country of ours. Why should not the Government respond to this demand of ours? There is no difference between the proposition of irrigation and the proposition of reclamation. It is the same principle reversed; that is all there is in it. The lands of the West were worthless because of a lack of sufficient water. The swamp lands of the South are worthless for agricultural purposes because of too much water. One is a proposition which the Government is now working out, upon which it is spending millions to make the land profitable, to put water on it; the other reclamation proposition is to take off water which now makes the land unavailable for farming purposes. The principle is the same and yet there is a vast difference, not in principle but in the thing sought after, in the thing accomplished. When you drain an acre of arid land in the West, Mr. Chairman, you do nothing except make another acre of farm land, for it was a barren waste before the Government went out there to reclaim it; but in the reclamation of the swamp lands, much more is accomplished.

Along every swamp and every morass in the South there are settlers living on the rims or borders of the swamps, populous communities that are as effectively separated by the swamp in many instances as they would be by a wall one hundred feet high. It, therefore, interferes to a most serious extent with the construction of good roads and intercourse between people which goes to build up the material and the social status of communities; but, worse than that, they are the greatest menace to the health of the people of the South that they have to encounter. Sanitary conditions have been improved enormously throughout the South by sinking deep wells so as to get below these swamps' surface waters, but you can never hope to make the South as healthy and invigorating and as bracing as it otherwise would be as long as these swamps and overflowed places are permitted to remain in their present condition.

It is, therefore, a proposition of drainage, Mr. Chairman, of reclamation by drainage. It is not only a question of adding more acres of farming land to the country, but it is an immensely important sanitary question. It is an important question in regard to good roads, and it is also a forestry problem, but I do not want to go into that now.

Now, what have we got here in North Carolina? I believe they say we have got over 4,000 square miles of these swamp areas in North Carolina. That is about three million acres that might be added to the agricultural land of the State. It is better than any three million acres that you have got now, and it can be reclaimed at the expenditure by the individual, by the State and by the Government of a trifling sum of money compared with the increased enhancement it would make to the value of that land. I believe there is enough of this land within a radius of thirty miles of Newbern to furnish homes, if it were put in condition for cultivation, for at least 25,000 people. What good is it now serving, this broad expanse within that radius of thirty miles? It is nothing less, it is nothing short now of a nuisance, a breeding ground for mosquitoes, a pestilence serving no good purpose to the private individual who owns it and in many instances worthless as an asset to the county and State, and a menace to the health of the whole community. They are as great impassable walls separating and segregating the people of eastern North Carolina so that they are seriously hampered in social and business intercourse and trade that would be possible to them if these obstacles were removed, permitting the construction of good roads. It is possible to remove these obstacles and thus give to our people the same blessings that other communities enjoy.

Mr. Chairman, I ask pardon of the convention for having spoken so long and so disconnectedly. To tell the truth about it, I had a certain line of thought which my good friends took away from me, and during the dinner hour I had to sit down and revise my remarks and proceed upon different lines, which accounts for the rather disconnected way in which I have discussed the subject.

At the morning session, September 10, the first address was by Hon. Chas. R. Thomas, Congressman from the Third District.

Address by Congressman Charles R. Thomas.

Every citizen of the State, as Mr. Small stated on yesterday, should co-operate in the improvement of our highways, good roads, also the waterways and public education, and also in this great drainage movement, because we have got a citizenship that in this day and time is progressing, that is making as rapid progress as any State in the United States. There were some fellows that used to say that North Carolina was a strip of land between Virginia and South Carolina, and it used to be called the State of tar, pitch and turpentine. It would be asked, what are North Carolina's principal products, and the answer would be tar, pitch and turpentine. It is no longer a strip of land between Virginia and South Carolina. According to these figures taken from the Census Office report, it is one of the most progressive States in this entire Southland of ours, in which we were born and reared, and to which we are attached by the tenderest and dearest ties, and it is one of the most progressive States in the United States. Our people are getting more wealth, they are getting more refinement, and everything that goes to make a great State. Along all these lines of development North Carolina is making vast progress. With many industries yet undeveloped in the past decade in agriculture, in manufacturing and in everything that makes a State good and great. Let us in the next decade go still further forward until North Carolina beyond all question, having solved other problems, has become among the foremost States of the South, and of the American Union.

Now Mr. President, this convention is to inaugurate. We do not expect to do it in a day, a month, or a year, or maybe ten years. It took ten years to get the inland waterway. We are going to co-operate, the representatives in Congress, the citizens, and the Legislature, we are all going to co-operate in this movement. Of course there may be objections, and it finally rests with the Legislature, and with Congress and with the people. We understand that we are going to start this movement for the progress and the development of the great good of the whole commonwealth of North Carolina.

What is our object here to-day, on which we are concentrating our attention? It is well enough, as old Daniel Webster stated in one of his speeches, to state the object of this meeting. I have been talking about North Carolina. What is the object of this particular meeting here to-day? It is stated in this call issued by the State Geologist:

"At this convention plans will be considered for draining the swamp lands of North Carolina that will make it practicable for all owners of land suitably located for draining to carry out the drainage plans without any immediate outlay of money. In other words, the drainage of the swamp lands can be accomplished without its costing the owner any money except what he is able to derive directly from the land itself and due to drainage. It will represent money that it would be impossible for him to obtain out of the land under normal conditions."

As Mr. Wright stated yesterday, the State would lend the money to drain the swamp lands, and that in three years that you would raise on one acre alone enough to pay your drainage assessment. That is the object of the convention, stated in that call. It is not a gold brick, as it has been tested and tried for twenty years, in Illinois, Indiana and in another State, Iowa, Mr. Wright mentioned. He mentioned those three States in particular. He stated that in Indiana there were cess pools, and they had what they called hog sloughs. There is not a single acre of undrained, undeveloped land in the State of Indiana to-day. It took twenty years to do it, but the whole State has been reclaimed, and he stated that he had never known any drainage loss, except in the case of non-resident owners to pay the drainage tax where the land was forfeited for the non-payment of the drainage tax. Here and now begins a movement in North Carolina to reclaim the swamp lands of the State, which will be by means of State and National laws, backed we hope and believe by public sentiment. We do not expect to do all of this at once. Rome was not built in a day, and in North Carolina as in other States, we are going to start and day by day and month by month we are going to try to develop this plan for the betterment of the conditions, especially as to waterways and good roads in North Carolina and the South. It is certainly worth the experiment. I met sometime ago Dr. Hannis Taylor, who has had conferred upon him the degree of Doctor of Laws. He was Minister to Spain under Mr. Cleveland. He was born in this State, and he lived, I think he told me, in the same brick house in this town in which the ——————— now live, next to my house; that is where Hannis Taylor lived for a while, and he told me in a conversation that a Spanish diplomat had said that whenever Romero was asked to do anything that was difficult, he would say, this Spanish official, it is very difficult, but I will try, and when it was a thing that was almost impossible to accomplish, he would say, it is impossible to accomplish, but we will do it anyhow. That is the correct principle. I found out early in my career as a public man that the great thing in life was to try, if a thing is difficult, yes, if it is impossible, the thing is to try to accomplish it, and if you try, nine times out of ten you succeed. Even if the drainage of the swamp lands in eastern North Carolina seems impossible we can accomplish it; we can accomplish it by co-operation. My friends there is no great movement that the world has ever seen that has been carried to perfection, unless there was an effort made, unless you tried.

When I ran for Congress, the first campaign I made helped to win in the election, and this illustrates my purpose, otherwise I would not say it. I said to my opponent: "John, here is your record in Congress, here is what you have accomplished." And he said: "Well, it is a Republican administration and I could not do things." "Well," I said, "John, why didn't you try, why didn't you try"; and I said "if you did not succeed, try, try again," and the people took it up with a shout, and I have heard it in that county ever since. I go back there now, and they say, you told him to try, and that is the correct principle on which to proceed. That is the principle upon which we are going to proceed in this Drainage Convention. We are going to try to secure an adequate State law, and we must have a National law to co-operate with the State law. Our idea has been to secure this legislation, and then it is up to the people to put the law in force. We are simply trying to inaugurate the movement. We are not insisting that it should be carried out, we will simply try to obtain the laws, and it is up to the people. We must have their co-operation to enforce the laws. The best experts say that drainage is entirely practicable, that the drainage of the lands of North Carolina would increase the permanent value enormously, from lands that are worth almost nothing now to lands that would be worth $100 per acre and upwards. My friends, you remember the old Hines farm out here. I went out there one day, and I remember that it was out there that I smoked my first cigar, and it was impressed on my memory, and that land was worth then $5 per acre, and now you cannot buy it at any price. It is now Oaks Farm, and on the early truck crops they make thousands of dollars every year.

I want to say here before I pass on, that I have no sympathy for a man who criticises experts. What we are spending for the army and navy, what we are spending for other government objects is a mere drop in the bucket. Experts' advice upon all matters affecting public interests is of the greatest importance in my humble opinion. There are some who depreciate expert advice; there are some who say it is extravagant. See what the United States is doing through that great Department of Agriculture, see what it is doing for the people through these experts. In my opinion it is one of the most valuable works of State and United Government.

Now we are not going to have anything but what you call a tentative law, that is the Legislature has to pass it. The Legislature represents the people, and they know what is needed, and in addition to the law passed by the State Legislature it would be advisable to have Mr. Small, Mr. Godwin, Senator Simmons and myself, and probably twenty-five representatives of the different States, go to Washington and advise with the Secretary of the Interior about what kind of a National law we should have. We thought that inasmuch as the United States was applying proceeds to irrigate the dry lands of the West, we thought we should have something applied to the drainage of the eastern lands.

One of the first bills that was introduced in Congress on that subject, and I have it here before me, was to drain the Dismal Swamp. They reported favorably on that bill, but they kicked terribly on it. (Bill is quoted.)

Now our whole aim and purpose in framing that bill was to frame a bill that would benefit the individual landowner. The irrigation law of 1902 provides to take the funds from the sale of public lands in certain States which are named here in the bill that was framed. The bill I have here provides for taking the lands from all the other States which are not named in the Irrigation law. In our bill we only take the proceeds of the sale in those States which are not named in the Irrigation law. If it is fair for us to have their lands irrigated, it is fair for us to have our lands drained. In order to secure the best results we must have a State Drainage Law and the National Government in co-operation with the State. Unless we have the right kind of State Drainage Law, and the law that is proposed in brief, and very brief, is simply this, to have a number of landowners, a majority to rule. Then they can issue bonds, bonds to be paid off in installments, the first due in three years, and we should get a national law to co-operate with the State law. The money will be taken from the proceeds of the sale of lands and loaned for the drainage of these lands. This bill which we introduced is not perfect in my opinion, but we are going to perfect it in these details, and we are going to secure the co-operation of every section of the locality, and we are going to protect the State and the individual landowner. The drainage is to benefit the small landowner, and the man who has the small farm. With this good State drainage law as a basis, and with the national law, and I believe it is stated by Secretary Wilson's report that there are now one-half of the States of the American Union that have State drainage laws, so there could be co-operation between the State and the National Government. With this good State law passed by the Legislature in their best judgment, and this national law which we hope to perfect and pass, we feel sure that in the course of time we can accomplish this great work which will tend to the development of eastern North Carolina. As I stated before, we can only suggest and inaugurate this movement, and give you our best judgment, and it remains as to the final action with the Legislature and the Congress of the United States and to the people.

The next address was by Mr. E. W. Myers, hydraulic engineer, of Greensboro, N. C.

Cost and Value of Drainage.

BY E. W. MYERS.

Drainage is the process of removing superfluous water from land, whether this superfluous water is found on or beneath the surface, and as he object of drainage may be either for sanitary, road improvement, or gricultural purposes, the methods to be employed and the results ttained will probably vary with the end in view.

While the especial reason for this meeting is the consideration of the problem of agricultural drainage as applied to swamp lands no presentation of the benefits to be derived from drainage would be complete without some brief reference to the other branches of the subject.

Sanitary drainage is a matter that affects in some way more or less directly the health and physical well-being of every citizen, and there are but few communities where general health conditions could not be improved by careful attention to the proper drainage of the vicinity; or if this end cannot be attained, then by the removal of all standing surface water at least. Sanitary drainage is beneficial in many ways, but probably its most marked effect is in the prevention or very great diminution of diseases of the malarial type and drainage less thorough than that usually necessary for farm purposes, will suffice for these purposes for it will serve to remove all standing water, so that mosquitoes are unable to find a breeding-place. A mosquito does not necessarily mean a case of malaria for not all mosquitoes can transmit this disease, though doctors are agreed that there can be no transmission of it except by this means. No mosquitoes therefore would mean no malaria. It is of course not possible to entirely exterminate mosquitoes throughout the world, but many places can abolish them locally, for unless driven by a favorable wind, they do not fly far from the place where they are bred; and drainage of all small pools and swampy areas within half a mile would under ordinary circumstances probably remove this source of annoyance and danger from any given spot.

The famed mosquitoes of New Jersey are actually in danger of becoming extinct in certain portions of that State because its citizens have resolved that they were not desirable inhabitants, and therefore in many places they have destroyed the breeding grounds by proper drainage.

In the great marshes near Rome it was first conclusively proved that malaria is transmitted by the bill of a certain species of mosquito. These marshes are now being drained, and as the drainage work progresses the very fatal malaria of that region is disappearing with the mosquito.

Proper drainage is one of the great factors which renders it possible for the United States to construct the great canal now being cut through the Isthmus at Panama. Now the death rate in the canal zone is no greater than that found among men similarly engaged here in the United States. Formerly the mortality was so fearful that it is said that every tie of the Panama railroad cost a human life, and almost the same might be said to have been the cost of every yard of earth excavated there by the French.

Agricultural drainage is probably as old as the art of farming. It has been the fashion for orators expounding the advantage of irrigation to point to its great antiquity and to show how the valleys of the Nile and Jordan were watered artificially in the earliest times of which we have any record. The art of drainage is of almost equal antiquity for .in Greece at a very early period record is found of the reclamation of swamp lands by drainage. The earliest drainage project of any magnitude of which there is record was that for the reclamation of Lake Copias, a great marshy tract of 60,000 acres near Thebes. This same project has been orated in modern times and 20 miles of main canal, 2,000 feet of tunnel and a large dike have been constructed. At the outfall of the drainage channel there is a drop of 170 feet, which will furnish about 1,000 horsepower, and the water is then available for purposes of irrigation on the arid lands near the city of Authedon.

On the American continent the project for the drainage of the valley of Mexico is the earliest of which we have any definite knowledge. Here in the fourteenth century the Aztec kings built their city on an island in the lake and protected it by dikes of great magnitude. They divided the area which they drained into five districts so that the swamps were segregated about five lakes. These projects have been estimated to cover the whole valley of Mexico and have involved an expenditure to date of more than $20,000,000 but the results have been more than commensurate with the outlay for a great area has been drained, freed from malaria, and made productive in the highest degree. Holland has been engaged in the construction of vast drainage works for several centuries, and a larger portion of this area has been reclaimed from the sea by the construction of great dikes. Gravity drainage is impossible over large areas and the water must be discharged by pumping, much of which is done by power furnished by wind mills. Great drainage works have been carried out in England too, in recent years, in the reclamation of the great swampy areas known as the Fens. These great projects have added many thousands of acres to the lands of these countries, and these reclaimed lands are now among the greatest producers of food products in the world.

Many drainage works have been undertaken in the United States by individuals, corporations, districts and States. Work has been done in Louisiana near New Orleans, in Florida in the Everglades, in Minnesota and North Dakota, in Indiana and in California. There is a State Drainage Commission in Minnesota with a generous annual appropriation, which is expended through the medium of a drainage engineer in the actual construction of ditches, while swamps have been made for the drainage of nearly the whole of the upper portion of the State. Many miles of canals have been located through the whole of the Red Pine valley and a numbe of miles have been constructed.

In California, the State has been engaged for a number of years i studying projects for the drainage of the tule land in the lower Sacramento and San Joaquin valleys. These lands are so situated that gravit drainage by ditches has been found impracticable and the reclamation i by the construction of levels and the pumping of the enclosed and som of the works are of great extent covering from 17,000 to 60,000 acres an involving expenditures ranging from $15,000 to $1,250,000. The tota expenditure in the district has been about $17,000,000, and projects ar now being worked out for the expenditure of many millions more.

Some work has already been done in the drainage of the Everglades i Florida through grants from the State, and more is in progress. Th United States Government has recently shown a disposition to aid in th reclamation of swamp lands by drainage, through the Division of Irrigation and Drainage Investigation. This Division has been examining swam areas, and has prepared plans for the drainage of several different kind of swamps, as examples for the neighborhood. An instance of this is complete survey of the west side of the Red River valley in North Dakot and the preparation of places and estimates for the complete reclamatio of the swamps of the need.

Work has also been done in the vicinity of Charleston. Several bil have been introduced into Congress having in view the construction drainage works of the Federal Government, one providing for the drai age of the Dismal Swamp, another for the drainage of the swamp lan of Minnesota, while others provide for the establishment of a draina fund and the construction of works for the reclamation of swamp ar overflowed lands in all the States. All of this work is projected because is recognized that in most of the humid States the greater portion of t naturally drained land is already in cultivation, and while there are po sibly 12,000,000 acres of good land in the arid States that may be broug under irrigation within the next twenty-five years, demand more th keeps pace with the supply. In the United States there are more th 80,000,000 acres of swamp or overflowed lands of which probably one-ha are susceptible of reclamation by drainage, and at a less average cost p acre than is necessary to irrigate the western lands. In this State alo there are probably more than 2,000,000 acres of land in our swamp are and if one-half can be disused, then one million productive acres can added to our farm lands, or more properly speaking to our garden wee for by far the greater portion of this land is located in the market-garde ing, truck-growing section of the State.

Figure for a minute what one million productive acres would be worth to the State. Divided into farms of 40 acres each, they would furnish support for at least 25,000 families and would add probably in excess of a million dollars per annum to our resources.

These acres are, however, idle and unproductive and to fit them for production they must be drained, when they will become capital yielding larger interest to those cultivating them. The soil is the farmers' business capital. He exchanges a certain sum of money for it or comes into possession of it by inheritance, and to its products he must look for the returns from his investment. He must solve the problems of its culture, for on the correctness of his solutions depends profit or loss. One of the well-recognized means of bringing about this result and making the farm pay is to remove the surplus water from the soil.

Superfluous water, or water in excess of that required for the best growth of plant life of commercial value and importance is due primarily of course to the rainfall either on the affected area or on areas tributary thereto, and this condition of soil may be either temporary or permanent. If it is a temporary condition, then there is a certain amount of natural drainage, sufficient in ordinary times and under ordinary conditions to take care of the precipitation; if the condition is permanent, as it is in certain areas, among which are the areas which are termed swampy, then the natural forces which tend to remove superfluous water from the land are for some reason impeded in their action. In either case, artificial drainage is the remedy for the condition. These permanent swampy areas are so for one of two reasons: the lack of drainage may be due to the fact that the general elevation of the surface is so nearly that of some nearby stream or other body of water, that there is no natural point of escape for the water standing on the lands or imbedded in the soil spaces. This is a not uncommon type of swamp in this portion of the State along the rivers, and the drainage of such areas would require special means.

A more common type of swamp, however, is that in which the general elevation of the surface is sufficiently above the water level in its natural outlet to permit of ready drainage, but this does not take place naturally because the small surface drains and channels are so choked with vegetation as to pond the water over the land, and thus a more or less constant water level may be maintained in this country of abundant rainfall, or if at times water does not actually stand on the surface, still such lands are more or less thoroughly saturated at all times and cannot be cultivated. In some instances there is no natural drainage channel for a swampy area, in which case the surplus water from the rainfall must collect in the lower portion of the basin until the demands of plant life and the amounts lost by seepage and evaporation balance the inflow. Whether this condition of superfluous moisture is temporary, as in many lands or permanent as in the swamps and swampy areas, the same general method of treatment would be applicable. Every drainage project is an assistance to nature and all drainage construction, to be successful must follow the lines laid down by nature. Water under the action of gravity tends to flow from a higher level to a lower, and man aids nature by providing channels along which this flow can take place. A greater or less number of canals, ditches and drains are constructed starting from some point where the water can be delivered, usually some stream, and reaching out to all portions of the area around, and so distributed and so constructed as to depth, width and grade as to remove the undesirable water from the soil. The whole work, to be successful, should be adopted to accomplish this result at all times and under all conditions.

The other possible method is in the ultimate reverse of this, the main drainage being from a land level to a higher, and in this case of course mechanical means must be provided sufficiently powerful, to elevate the necessary quantity of water to the desired point of delivery, while there are areas within our borders which are so situated as to render this mode of drainage the only possible one. Certainly there are none which it will be economically possible to treat in this way, though given the condition of a timber area and a congested population such treatment may become a highly profitable enterprise. In any drainage project the essential feature to be considered is the matter of cost. The benefits to be derived from it must be sufficient to outweigh the cost of carrying out the work. What will it cost to reclaim the land and what will it produce when reclaimed and improved; all questions to be solved. That the cost of the improvement must not be greater than the benefit to be derived from it is a maxim of the drainage laws, as well as in the conduct of ordinary business. Therefore, the first question to be answered in regard to any drainage scheme is "will it pay?" not in pleasure or satisfaction, but in dollars and cents.

As a general proposition the question may be answered in the affirmative, but in any particular case it cannot be answered until the cost of the proposed work has been closely estimated and balanced against the increased value of the affected lands. Neither of these can be determined without a careful and comprehensive examination of the area in question for the cost of the necessary improvements depends entirely on local conditions and each area presents a problem of its view.

The end to be accomplished is the removal of all water not needed to grow crops, but the means whereby this end may be attained will vary very greatly with different areas. In some countries a single ditch has been known to drain well land for a mile on either side of it, while in other conditions a line of drain tile every 50 feet may be necessary to produce the same result. In the first case the cost may be less than $1 per acre, while the cost of thorough tile underdrainage under average conditions may be from ten to twenty dollars per acre. Just what the cost will be can only be determined by investigation.

After having arrived at the probable cost of the work, it will be easy to estimate the increase of crops by comparing the acre to be drained with one which is naturally drained and whose productive powers have been well ascertained, in case the improvement is to be made on lands already wholly or in part under cultivation. If the area to be drained is not in cultivation the value per acre after draining may be estimated from the value of drained lands in the vicinity of these or any such. In regions where much drainage has been done the condensed evidence upon the subject of profit is that draining pays from twenty-five to fifty per cent annual profit on the investment. The profits accruing from the drainage of fertile land are of two kinds: first the increased yield of the commercial products of the soil, which has a direct money value to the producer, and second, the increased healthfulness of the community where drainage has reclaimed the waste land. This has a money value which is unquestionably very great, but which it is exceedingly difficult to measure. It is to be regretted that there are no home statistics from which these statements may be illustrated. Some years ago an investigation was made by the Bureau of Statistics of Indiana to determine the influence of tile drainage on health and crops, and a single township of the State was selected. Where drainage was one of the marked improvements, and covering a period of five years after most of the townships had been drained by consulting farmers who lived in the township during both periods, it was discovered that the average crop of wheat in the five years before drainage was 9½ bushels per acre while the same land, after drainage, for five consecutive years produced an average of 19¼ bushels per acre. The average yield of corn for the first five years was 31¼ bushels per acre while the average yield in the five years after drainage was 74¼ bushels per acre.

The physicians of the townships were asked to report from their books, and it was found that in the first five years there had been 1,480 cases of malarial diseases while in the second period there had been 490 cases.

From these facts it seems certain that drainage has greatly increased the health and wealth of that community and thereby added materially to the wealth and prosperity of the State. The universal productiveness of the lands may be ascribed to the following effects of the drainage.

One of the changes produced by relieving the ground of its surplus water is increased firmness, which facilitates its culture, and also incidentally makes better roads through the region. The fineness of the soil is also increased by the percolation of water downward from the surface; permitting air and frost to more thoroughly disintegrate the soil particles, reducing their size and increasing the capacity of the soil for capillary moisture, making it more capable of resisting drought.

Drainage admits of earlier and more timely cultivation in many localities. The excess of water has been removed from the soil and the water passes down admitting warm air and fertilizing rains to such an extent that the surface is well prepared for the crops requiring early planting much sooner than wet soils. This is of great advantage not only to the seasons' work, but often makes the difference between an excellent and profitable crop and a poor one.

A certain degree of soil ventilation has been found essential to bring heavy lands to the highest stage of productiveness. When the level of the water is lowered, the roots of plants penetrate more deeply into the soil and as they die and decay an intricate network of minute channels is left, extending to the surface through which air circulates. The soil spaces being relieved of water are filled with air, which carries with it the fertilizing gases it contains furnishing oxygen to the roots of the plants and for the support of soil bacteria which are now recognized as playing such an important part in the conversion of the vegetable matter of the soil into nitrates. These elements of fertility are absorbed by the soil and held in readiness for the plant roots. These processes are continuous and play an important part in the productiveness of soils. In other words, well-drained soils do not become exhausted as soon as undrained ones where no fertilizer is used.

Drainage increases the temperature of the soil since a soil cannot become warm until the water on its surface is evaporated or thoroughly warmed by the sun. Since a large amount of heat is required in evaporating the excess of water, it is evident that to drain the surplus water away rapidly rather than hold it there until it has time to evaporate must greatly aid the warming of the soil. Experiment has shown that soils after drainage will be from 5 to 10 degrees warmer than they were before under the same extreme temperature conditions. Drainage also prevents a waste of fertility through surface washing since the object of all good drainage is to remove the surplus water through the soil instead of over it, preventing the washing away of the fine soil particles which constitute its richest part. A drained soil becomes renovated, opened up to the full depth to which it is drained, an additional field being given to the plant roots from which it draws nutriment. A drained soil resists drought better than one not drained for the additional fineness of soil produced makes it capable of returning a large amount of capillary water and the greater depth of soil from which the plant roots can draw sustenance, both contribute to the power of a drained soil to resist the effects of a protracted dry spell during the growing season. Having said this much on the general question of drainage, it remains to consider the concrete question of the possibility of the profitable drainage of our swamp lands. The question is again that of cost and so far as the State lands are concerned, the possibility of disposing of them at a profit after they are drained. Some lands which are unproductive before drainage are equally so after it, though such cases are very uncommon. The question "will it pay?" can only be answered definitely after an investigation is made for the purpose. We know, however, that no better lands in other States have been drained and are now very valuable farming lands, and there is no evident reason why these lands should not become valuable farming lands also. Nor does there seem reason to believe that productive drained lands situated as are our swamp lands cannot be sold for a price sufficient to pay a handsome profit on any probable cost of improvement, for all over the United States there is a great and a growing demand for good land. Our population is growing at a rapid rate, and more acres each year are required to produce the needed food and clothing. Productive lands must be made more productive, waste lands must be brought into use. Out in the arid West the Government, great corporations and private individuals are spending many millions of dollars to bring needed moisture to enable land to be successfully cultivated. The actual expense of these undertakings range from $25 to possibly $100 per acre of land which will receive water, but farmers are glad to pay these prices for the water in addition to the cost of the land because the lands are productive and they can so use them as to pay a large return on the amount invested. The area of these lands is limited and the only other source from which the needed agricultural lands can be had is the reclamation of our swamps. It is not probable that the cost of draining them will ever be less than it is now, so at its best let us look into the matter.

The drainage of swamp lands and its relation to public health was ably discussed by Dr. Francis Duffy.

Drainage of Swamp Lands and Its Relation to Public Health.

BY DR. FRANCIS DUFFY.

Gentlemen.—I will endeavor to address you on this subject as requested, briefly.

The drainage of swamp lands, from a sanitary standpoint, means chiefly what is meant by the breaking up of the breeding ground of mosquitoes. It does not mean that only. Take the subject of tuberculosis, a subject that is occupying a great deal of the attention of the world, now, especially in all sanitary circles. As the general health of a community is improved by drainage or anything which affects, for the better, soil and atmospheric conditions, so much the greater resistance is offered against this disease, the germs of which sooner or later find lodgment in the bodies of most individuals. The death rate from tuberculosis shows that of all deaths, one in every ten, or some say one in every seven, is from tuberculosis. Think of that, all the wars, all the diseases of little children, typhoid fever, Bright's disease, malarial fever, railroad accidents and every other cause of death, still, this single disease, tuberculosis, is able to claim so large a share of victims. The thing is startling, the general public does not realize it. If they did, there would be very much more attention paid to the prevention of tuberculosis. Certainly, no individual would be so unmindful of his own interests and that of others as to neglect a subject of such vast importance. Now, the drainage of swamp lands has only that relation to tuberculosis as far as I know. Swamps do not breed the germ, which is as definite in its position and character as the germ of corn, and produces its kind as the grain of corn. But, like the grain of corn, it has got to have suitable environment. Corn will not flourish in dry places without moisture; it will not grow on stones. When we have excessive moisture we have one of the favorable conditions for disease.

Passing from tuberculosis, we have to consider the mosquito as a cause of disease, swamp grounds being breeding grounds for mosquitoes. There are a number of varieties of mosquitoes and several diseases which are known to be produced thereby. Perhaps, there are more that have not been discovered, for it seems that nearly every year something more is found out. Our text books, until recent years, had no mention of the relation of the mosquito to malarial fever, which claim so many victims every year. Malarial fever is produced by a certain kind of mosquito, the Anophele, which is not the most numerous variety. This mosquito breeds in stagnant water, bites an infected subject, sucks the blood and thereby becomes the intermediary host of the malarial germ, which after a brief period of development, is capable of being injected by the bite of the mosquito into the body of another victim, causing some variety of malarial fever, according to the specific nature of the germ. A single bite may cause infection. This is a night mosquito and does its mischief from sundown to sunrise.

Elephantiasis, a disease of tropical climates, sometimes occurring in this neighborhood, is one to which the mosquito stands in causative relation, in at least a considerable number of cases. A parasite, the *filarie sanguinis hominis,* having gained access to the human body may be taken in by the mosquito and water polluted which, being drunk, causes infection. Possibly, the mosquito may inject the germ directly. As no particular mosquito has been named in this connection, it is likely that our very numerous culex is able to do this mischief, provided only, it first finds a diseased subject to feed on. This disease is characterized by an enormous enlargement of a limb or some other part of the body, the lymph channels being occluded at points below which they are distended.

At least thirty years ago, I was consulted by a man who said he had been stung or bitten by something. The limb began to swell, and took on a character I had never seen before, nor have I seen such since. It was not an ordinary inflammation, but the part became so swollen and ulcerated that it had to be amputated. Going to Philadelphia, later, I exhibited it to the Pathological Society, which was then in session. It was thought to be a case of Elephantiasis. It may have been that the man was bitten by a mosquito.

Then again, there is the yellow fever mosquito, the Stegomyia. It is not so much an animal of the swamps, which, however, stand in some causative relation to its existence. In the language of a Marine Hospital bulletin, they might almost be called domestic animals as their habitation is usually about the house and chiefly in towns. Yellow fever is caused by their bites when they have previously been infected by a diseased subject. We know something of the ravages of that scourge and the importance of anything which will prevent it. Now, the most harmful mosquito is the one that breeds in stagnant places; it scarcely breeds in running water but in these stagnant places, many of which may be drained, this mosquito breeds in great numbers. Sometimes when I have spoken of the mosquito theory, when I have had opportunity of talking about it to the laity, persons have scoffed at the idea of such a thing being possible, stating that they would all have been dead long ago. But one may be bitten by the dangerous mosquito but if it has not already become laden with the dose from some infected person, it will not infect the person bitten; but a subject which is infected is capable of conveying it to others through this mosquito. Not many years ago, I was called in consultation in the night to a man who was dying of hemorrhagic malarial fever; he had recently married, having a wife and one child. I realized that that man, like many others, was as surely killed by a mosquito as if he had been bitten and killed by a rattlesnake. A very short time after that I was called to see his child. The child and the widow presented a sad picture. I prescribed for the child and started away. There was a pond near the house and I noticed that it was discolored. I turned back and spoke to the people near the pond and asked why they allowed such a thing to exist and to breed mosquitoes, and spoke of the damage which had been done as there had been a number of hemorrhagic and other forms of malarial fever in the neighborhood. The lady said, "I wish you would speak to father about it, for he does not seem to think that it does any harm." That man is one of the most intelligent in a community of intelligent men. It is only a question of ignorance of a subject, not generally understood, outside of medical circles; otherwise, people could not be so unmindful of their own welfare. When I look around at this convention, seeing so many gentlemen here whose general knowledge of the world makes them conversant with things discovered, I felt that they knew about as much about it as I do, and it was hardly worth while for me to talk to them on these lines; yet, only last summer I met a gentleman who has occupied a high place in the councils of the nation, and, he has been governor of a State; and I began talking on lines that I am now talking on and he told me that he did not believe a word of it. He said, "How do you ever get it? The mosquito has got to bite somebody who has got malaria, and an infected person must get it from the mosquito." And it did look to the bystanders as if he had me cornered. I replied, "It is like the egg and the hen. Which started first; was it a special creation or an evolution from some other form of life? It is possible there may be lower forms of life under such environment that one form may change to another. Spontaneous generation has never been known to occur. We know that the malarial germ exists and people are foolish to doubt its existence because we cannot trace the origin. The cause of malarial fever has been demonstrated thoroughly; persons have been taken, who were healthful, and kept under wire screens on dangerous marshes, and they remained healthful, and other persons have been exposed outside of the screen, and they were promptly infected with malarial fever."

In North Carolina great advances have been made in the enactment of laws for the protection of the public in relation to the practice of medicine and in the direction of sanitary improvement. Small appropriations have been made for the maintenance of a Board of Health and of laboratories. Bulletins are issued by the Board of Health and something has been learned from this source by some people, but it is a slow growth. Sometimes a bulletin goes out relating to typhoid fever, which is claiming its thousands all over the country, and sometimes of tuberculosis, and at other times relating to other important subjects.

I suppose these bulletins are noticed chiefly by the medical profession. But the general people have more need of them and ought to get them. They ought to go in the homes of the families. If enough money has not been appropriated to put them free to everybody, then enough should be appropriated. As far as the doctor is concerned, the conscientious man is continually doing a sort of missionary work, teaching the people along these lines at his own expense. Why should not the people take more interest? Few are so ignorant and so callous as to have no interest in stopping sickness, but there is comparatively little interest now among the people on whom it seems a sanitary era is about to dawn.

I saw two men in my office recently, both of whom came from a neighborhood where typhoid fever was prevailing. I felt it was my duty to warn them against flies and infected wells as causes of typhoid and I did so with some carefulness. One of them was silent, the other said, "Well, whenever I get thirsty, I drink water wherever I can get it." And that is about so. You may take that as an illustration of the general knowledge of the people about these subjects. I don't think there is anything that the people of the country could be interested in which would be of more advantage to them than to learn to protect themselves along the lines of sanitary science. Speaking with a health official several years ago on the subject of preventable diseases and their ravages, I remarked, that if a ravenous beast went daily from county to county devouring a human victim every day, getting three hundred and sixty five per year, the people of the State would spend, if it were required, an enormous amount of energy and capital for his destruction. But such insidious scourges as tuberculosis, typhoid fever, malarial fever, hook-worm and other cripplers of the body, and destroyers of life, though claiming ten times as many victims, excite but little alarm and cause but little outlay, except that which is forced on the victim and his family. Instead of being regarded as the impositions of faulty sanitation and environment, they are considered more as inevitable natural events or the mysterious dispensations of a Divine Providence. Recent newspaper correspondence from Africa tells of the desertion of several villages because a few of the natives were killed by lions. When I saw this, I remembered my conversation with the health official. The physician reaps his harvest of dollars when disease runs riot, but the average doctor is not on so low a commercial plane as not to willingly impoverish himself if thereby he could abolish disease.

Nor, need his occupation be gone, but rather changed in the fight for prevention, rather than attempts at cure. But, do not dishearten him with indifference, suspicion and parsimony. The American Medical Association is now moving, through the ramifications of its organization, to create a department of public health in the National Government. Our National legislators will be confronted with this subject. Let them give it their earnest consideration as of more importance than the strengthening of party lines, or of almost any measure which may be submitted to their judgment. Our worthy politicians are not only popular leaders but are followers of the populace. If we can disseminate and create a demand in the homes, all that can be accomplished by legislation will soon be enacted.

In response to a request from Mr. Small, Dr. Caton of Newbern made a few remarks on this same subject.

Gentlemen.—I do not know that I can add anything to what Dr. Duffy has said, as he seems to have covered the ground pretty well so far as malaria is concerned. I observed one thing, which I do not know that he has mentioned, and that is, that the most severe types of malaria are found chiefly among the poorer class. I presume that may be because they screen less than the better class. I have been practicing now for ten years, and, with the exception of one year, my practice has been in eastern North Carolina. I have seen comparatively few cases of this severe type of malaria among the better classes. The type of malaria that Dr. Duffy referred to more especially appears every other day, sometimes every day. There is one which the doctor did not touch upon and that is the hookworm disease. After malaria, I believe it is the most important disease that we have to deal with in eastern North Carolina, and in the eastern sections of other States. We know these cases. They are what people fifteen or twenty years ago called clay-eaters. In boys and girls anywhere from six to eighteen years old, you recognize the disease by the bloated and very pale expression. This disease is caused by a little worm. It is usually about one-half inch long and curved at one end which gives it its name.

We think that these cases are certainly all gotten from shallow water. We do not think that they get it from deep wells. Of course the surface water drains into these shallow wells and carry off these little worms, and these eggs develop into worms and the people get them from the water; or, if they are not developed into worms, they swallow the eggs. I think that is one of the most important diseases and it is one which can be prevented by deep wells, and that may be taken up by Dr. Lewis. I think we should have these little pamphlets distributed among the laymen.

The next speaker was Hon. H. L. Godwin, Congressman from the Sixth District.

Address by Congressman H. L. Godwin.

Mr. Chairman and Gentlemen of the Convention:

It will be impossible for me to say as much upon this important subject as I would like to in so short a period; but I am indeed glad to be here to-day at the first North Carolina Drainage Convention held in Newbern, historic old town of Newbern, because I believe, gentlemen, that this convention dates the beginning of one of the most important projects to the people of our State. I believe, as we go forward, as we will certainly do in the future, and develop the project of the drainage or reclamation of swamp lands, as we will; and, as we have succeeded and accomplished other wonderful undertakings for the State of North Carolina, which we are proud to boast of, which have made North Carolina what she is to-day, I believe as we look back ten years hence, we will see that this convention will go down in history as one of the most important meetings in our State. I cannot add much to what my colleagues have said; neither can I add anything to the medical expert testimony and other addresses that have been delivered here, but I want to say that, if we will go forward in this movement with the determination to succeed, we will succeed and we will be strong and gather strength in our undertakings. It is well that we should meet here to-day. It is a wise step that the people who are interested in the great question of drainage has taken and the people of North Carolina are to be congratulated upon this meeting held here yesterday and to-day, and if Dr. Pratt wants to know how much we are interested in the subject of drainage, I want to tell him and tell you that immediately upon getting information that the State Drainage Convention would be held here, and that Mr. Wright, the expert drainage engineer upon this important subject, would be here to-day, I communicated with the Department at Washington and secured the services of Mr. Wright to accompany me, beginning with to-morrow, through my district, to address several large farmers' meetings in the various counties of my district. We are not only interested in the subject of drainage, but we are interested in all other subjects that will naturally come after we have achieved the reclamation of our swamp lands. Then we will have the proper conditions in our rural districts that the country people are entitled to to-day, and have been entitled to in the past. Talk about the farmers having to move to town to send their children to the graded school! Why, the man in the country is as much entitled to a good graded school as the man in the town and, whenever the farming people of North Carolina, whenever the people who live in the country and on the land that produces the wealth of the country, come together and study these vital questions like the merchants and others study their callings, then the reclamation of swamp lands will be an easy matter.

Mr. Thomas said it would require co-operation. That is true. Mr. Thomas said it would require actual work, and this is true, but it will require the actual work and co-operation of the farmers of this State. Your representatives in Congress are heart and soul for the project. The representatives that you will elect to the next General Assembly of North Carolina will be as one man for the drainage of the swamp lands of the State, but they are not going to act. A public servant is slow to act until he has obtained the will of the people and the thing for the people who are interested in drainage to do is to come together and express their desires and determination to have their lands drained. I have not been in Congress as long as Mr. Thomas and Mr. Small, but I have been there long enough to know that whenever a representative in Congress ascertains that the people of his district are down behind him on a certain proposition, you will see that representative begin then and there to do everything in his power to secure that measure. Meet together on this question as the people of the State meet on other questions. You take lawyers and they meet annually. What for? They meet to study questions concerning their interests. You have heard the physicians who addressed us this morning talk about what they did in their Medical Conventions, what resolutions they passed, what discussions they had with reference to public interest and concerning their own welfare. Take the manufacturers, the men who are engaged in the manufacture of furniture or any other article, and you will see them attending the Manufacturers Association. What is the object of their coming together and studying questions concerning manufacturing? It is to find out and ascertain how to produce that manufactured product with the least cost possible. The grocers, the cotton spinners and men of almost every calling and profession of life meet together sometimes annually and sometime monthly and sometimes more often than that to discuss and study questions which relate to the business in which they are engaged. It is th duty of the people of North Carolina, if they are in earnest about th drainage of our swamp lands, to come together as one man and stan together and petition the Legislature and Congress for adequate laws fo drainage and for assistance, setting forth in that petition these desires and petition what they are going to have and there will be absolutely no doubt about the results.

Is drainage necessary? Who will deny it. Where will you find a man anywhere who will deny that it is an absolute necessity? Will the swamp lands of North Carolina produce well? Which of the lands of your State will produce more corn than any other? It is a fact that cannot be contradicted, a fact that has been found to be true in the U. S. Department of Agriculture that the lands of North Carolina will produce as much corn to the acre as the reclaimed lands of Illinois and Indiana. You have heard these physicians say here that it is absolutely necessary to drain the swamp lands from a standpoint of public health. Lay aside agricultural purposes, if it is necessary to drain the swamp lands from the standpoint of inducing better health, then it is the duty of the State to drain the swamp lands, but that is not all. The richest, the best, the most fertile soil that we have anywhere within the boundaries of our State to-day are in these swamps, fit for nothing, absolutely available for nothing, except timber purposes. What are we to do? Are we to remain idle when we are made conscious of the fact that it is necessary to drain the swamp lands from a standpoint of public health? It is a necessity from the standpoint of the population of the country. Every year we have landed upon our shores one million immigrants, to say nothing of the ever increasing population within the borders of the United States. We are increasing our population daily and we are not making a single foot more land. It is a duty that you people owe to the citizens of the country to make more homes for the people and thus build up the State. It cannot be denied that the swamp lands of North Carolina will be valuable for trucking purposes, and by their reclamation thousands and thousands of dollars would be produced every year by the truckers.

If we agree upon the fact that swamp lands should be reclaimed, then the question is how can we secure Federal aid or State aid to reclaim the swamp lands. We have a precedent for it. The Federal Government has gone out West and irrigated the arid lands of seventeen States—-lands in the western portion of this great country that were almost worthless and unfit for use. Now, we contend that if the Government of the United States will furnish money for the Western States to irrigate those lands where there is not enough water, it certainly becomes the duty of the Federal Government to come to the eastern section of this country and drain the swamp lands where there is too much water. I would not undertake to offer any expert testimony, but any man with any sense can tell you that it is an easier matter to get water off of land than to get water upon it. It will be an easier matter to drain the lands of the eastern section than to carry water to those lands in the West that are too dry.

One of the most valuable and impressive talks of the convention was by Mr. John A. Wilkinson of Belhaven, N. C., who told of practical results obtained by his brother, S. W. Wilkinson, and himself in the drainage of certain lands in Beaufort County. The substance of his remarks are about as follows:

About five miles southeast of Pinetown, Beaufort County, a canal has been constructed through one of our large swamp areas for a distance of five miles and having a width of 30 feet and depth of seven feet. Before this canal was begun, the people living in the vicinity of the swamp all claimed that it would be impossible to drain the swamp as there was not sufficient fall to take care of the water. The ones who were interested in the project, however, have had a survey made of the swamp and were confident that there was a sufficient fall along the line of the canal to take care of all the water and drain the land. As the canal was being constructed, it was found necessary at the end of a mile and a few years to construct a retaining dam six feet high in order to keep sufficient water in the canal to float the dredge. After another mile and a quarter of the canal had been constructed, it was found necessary to build another dam six feet high. After the five miles of canal had been constructed, the total fall in that distance of fall was found to be a little over 12 feet. The dredge was then taken back down the canal and the dams removed. During the extreme heavy rains of the past summer in eastern North Carolina, this canal was able to take care of all the excess water, and, as far as I could ascertain, it never rose over 15 inches in the canal. Last spring, in order to determine the actual agricultural value of the land drained, ten acres bordering on the canal were cleared by cutting down the trees and underbrush and burning them up, leaving the stumps. Corn was planted by means of a hand-drill made out of a piece of hollow gum wood. There was no opportunity for plowing the field, so the corn was planted by simply running the drill into the ground and dropping the seed. It was also impossible to cultivate the corn as it was growing, on account of the stumps. The fires, however, had destroyed all of the undergrowth so that there were no weeds to interfere with the growth of the corn. This tract produced an average of 40 bushels of corn to the acre, and this will give an idea of the great value of this land for agricultural purposes. With the construction of lateral canals, this main canal will be capable of draining from about 6,000 to 7,000 acres. Another advantage gained by the drainage of these swamp lands is the construction of a good system of roads along the banks of the canals. In connection with the canal just referred to, a road-bed has been made along the line of the canal.

At the close of Mr. Wilkinson's talk, the Chairman read the following telegram from the Greensboro Chamber of Commerce:

GREENSBORO, N. C., September 10.

JOSEPH HYDE PRATT,
Drainage Convention:

A cordial invitation is extended to attend Good Roads Congress, Greensboro, N. C., October 13, 1908.

CHAMBER OF COMMERCE.

REPORT OF COMMITTEE ON RESOLUTIONS.

The following report of the Committee on Resolutions was read and unanimously adopted by the convention:

I. WHEREAS, On account of the importance of the subject of drainage to the welfare of North Carolina, your committee resolves that it will be to the benefit of the people of the State:

First: That the Drainage Convention affect a permanent organization to be known as the North Carolina Drainage Association.

Second: That Mr. John A. Wilkinson be elected president of the Association. That Dr. Joseph Hyde Pratt be elected permanent secretary-treasurer of the Association. That the following vice-presidents be appointed, one for each county: P. H. Morgan, Currituck; F. F. Cahoon, Pasquotank; J. H. Small, Beaufort; W. S. Davenport, Washington; A. B. Croom, Jr., Pender; J. J. Wolfenden, Craven; E. M. Koonce, Onslow; John C. Parker, Jones; W. S. Chadwick, Carteret; J. T. Butler, Columbus; P. Rourk, Brunswick; S. S. Mann, Hyde; O. L. Clark, Bladen; J. A. Brown, New Hanover; Dr. H. C. Lilly, Cumberland; W. G. Ferebee, Camden; E. W. Myers, Guilford; D. M. Patrick, Greene; and in addition to these that Messrs. J. O. Wright and C. R. Vandecarr be appointed vice-presidents at large, and that others can be appointed at the discretion of the secretary.

Third: Officers shall be elected annually at the yearly meeting.

Fourth: That any one interested in drainage may become a member of the Association by the payment of $1 annually to the secretary-treasurer for dues—and that donations to any additional amount will be accepted by the Association to promote the cause of the Drainage Association.

Fifth: That any one interested in drainage shall be permitted to attend the meetings of the Association and to take part in its deliberations.

Sixth: That the president, secretary-treasurer and any three vice-presidents shall constitute an executive committee.

Seventh: That there shall be an annual meeting held once each year on the second Wednesday in September, the next meeting to be held at Newbern, N. C., and special meetings shall be called at any time and place that the Executive Committee may deem advisable.

Eighth: That the Executive Committee appoint a committee to secure appropriate legislation and to attend to all matters affecting the welfare of the Association. That the Secretary of the Association be Secretary of this committee, and that the President be an ex-officio member thereof.

II. WHEREAS, Mr. J. O. Wright has shown the keenest interest in the reclamation of the swamp lands of North Carolina and by his untiring efforts and assiduous labors has done so much to make the people of our State realize the absolute need for proper drainage, and is largely responsible for the gathering of this convention;

Resolved, That the unanimous thanks of the convention be tendered to him as a due expression of our appreciation of his labors in this cause.

III. WHEREAS, The municipality, people and newspapers of Newbern have extended to the Drainage Convention the kindest welcome and the most enthusiastic support as shown by the cordial welcome delivered by Mr. M. H. Allen, on behalf of his Honor, the Mayor of Newbern, by the presence and interest of the citizens at the several meetings of the Association, and their bounteous hospitality, and by the editorial expressions contained in the newspapers,

Resolved, That the unanimous thanks of the convention be tendered to the mayor, municipality, citizens and newspapers as an expression of our appreciation of their efforts in our behalf.

IV. WHEREAS, The Drainage Convention is indebted to the courtesy of Sheriff Biddle for the use of the court house as the place for its meetings,

Resolved, That the thanks of the convention be tendered to Sheriff Biddle and to the people of Craven County for their bounteous hospitality.

V. WHEREAS, The efforts of Joseph Hyde Pratt, State Geologist, and the Geological Board, of Senator Simmons, Hon. J. H. Small, Hon. Chas. R. Thomas and Hon. H. L. Godwin, their interest in the question of drainage and the studies they have made of the subject have contributed so largely to making this convention a success,

Resolved, That the unanimous thanks of the convention be extended to hem as a due expression of our appreciation of their untiring labors in his important cause.

VI. Whereas, It is manifest that the reclamation of our swamp lands or agriculture and the more effective drainage of our improved swamp ands will greatly enlarge the agricultural possibilities of the State and end to increase many fold the products of the farm; and

Whereas, There are only a limited number of people who are familiar ith the modern methods of drainage and reclamation and with the lements of fertility, and the proper cultivation of the black, alluvial ands of eastern North Carolina; now, therefore, be it

Resolved, That the North Carolina Department of Agriculture, either lone or in co-operation with the U. S. Department of Agriculture, be arnestly requested to establish a demonstration farm at some point on he black or swamp lands of eastern North Carolina during the year 1909 or the purpose of experimenting and demonstrating the best methods of rainage, preparing the soil, planting, cultivating and harvesting the taple crops of that section:

Resolved further, That the Trustees of the Agricultural and Mechan-cal College at Raleigh be requested to give competent instruction in the ature of the swamp alluvial lands in eastern North Carolina, both im-roved and unimproved, the proper methods of reclamation and drainage, nd the constituents and nature of the soil, and the most appropriate rops to be grown thereon, and best methods of cultivating and utilizing he said lands:

Resolved further, That the next session of the General Assembly be equested to authorize the Geological and Economic Survey of the State o employ at least one competent and efficient drainage engineer in order o more effectively prosecute drainage investigations, and to make surveys nd plans for drainage districts wherever the same may be necessary or uthorized by law, and that a sufficient appropriation be made to defray he necessary expenses thereof.

The report of the Committee on Legislation was then read by the hairman, Hon. John H. Small, who explained that the recommended egislation was modeled after the plan suggested by Mr. J. O. Wright in is address. The convention voted unanimously to adopt the report of his committee and to refer it to a committee of two, who should carefully evise it and prepare it for transmittal to the Legislature. The committee lected by the convention to do this work was composed of Hon. John H. mall, of Washington, N. C. and Hon. A. D. Ward, of Newbern, N. C.

REPORT OF COMMITTEE ON LEGISLATION.

There is given below the legislation recommended by the convention.

LEGISLATION RECOMMENDED TO MAKE PRACTICABLE THE DRAINAGE OF SWAMP LANDS IN NORTH CAROLINA.

TITLE.

An act to promote the public health, convenience and welfare by leveeing, ditching and draining the wet, swamp and overflowed lands of the State, and providing for the establishment of levee or drainage districts for the purpose of enlarging or changing any natural water courses and for digging ditches or canals for securing better drainage or providing better outlets for drainage, for building levees or embankments and installing tide gates or pumping plants for the reclamation of overflowed lands, and prescribing a method for so doing; and providing for the assessment and collection of the cost and expense of the same, and issuing and selling bonds therefor; and for the care and maintenance of such improvements when constructed.

SECTION 1. DUTY AND POWERS OF THE COURT.—The Clerk of the Superior Court of any county in the State of North Carolina shall have jurisdiction, power and authority to establish a levee or drainage district or districts in his county, and to locate and establish levees, drains or canals, and cause to be constructed, straightened, widened or deepened any ditch, drain or water course, and to build levees or embankments and erect tide gates and pumping plants for the purpose of draining and reclaiming wet, swamp or overflowed lands; and it is hereby declared that the drainage of swamps and the drainage of the surface water from agricultural lands and the reclamation of tidal marshes shall be considered a public benefit and conducive to the public health, convenience, utility and welfare.

SEC. 2. PETITION—BOND—BOARD OF VIEWERS.—Whenever a petition, signed by a majority of the resident landowners in a proposed drainage district, or by the owners of three-fifths of all the land which will be affected by or assessed for the expense of the proposed improvements, shall be filed in the office of the Clerk of the Superior Court of any county in which a part of said lands are located, setting forth that any specific body or district of land in the county and adjoining counties, described in such a way as to convey an intelligent idea as to the location of such land, is subject to overflow or too wet for cultivation, and the public benefit or utility or the public health, convenience or welfare will be promoted by draining, ditching or leveeing the same, or by changing or improving the natural water courses; and setting forth therein as far as practicable the starting point, route and terminus and lateral branches, if necessary, of the proposed improvement; and there is filed therewith a bond for the amount of $50 per mile for each mile of the ditch or proposed improvement, signed by two or more sureties or by some lawful and authorized surety company, to be approved by the Clerk of the Superior Court and conditioned for payment of all costs and expenses incurred in the proceedings, in case the court does not grant the prayer of said petition, the said clerk shall issue a summons, to be served on all the defendant landowners who have not joined in the petition and whose lands are included in the proposed drainage district. Upon the return day the said clerk shall appoint a disinterested and competent civil and drainage engineer and two resident freeholders of the county or counties in which said lands are located as a board of viewers to examine the lands described in the petition and make a preliminary report thereon. Such drainage engineer shall be appointed upon the recommendation of the State Geologist, and the compensation for the services of such engineer and his necessary assistants, to be fixed as herein provided, shall be paid preliminarily by the State Geological and Economic Survey, said sum or sums so paid to be refunded when the drainage fund is subsequently provided by the sale of bonds or otherwise.

When the lands proposed to be drained and created into a drainage district are located in two or more counties the Clerk of the Superior Court of either county shall have and exercise the jurisdiction herein conferred, and the venue shall be in that county in which the petition is first filed.

The law and rules regulating special proceedings shall be applicable to this act, so far as may be practicable. The summons may be served by publication as to any defendants who cannot be personally served as provided by law.

SEC. 3. EXAMINATION—PRELIMINARY REPORT.—The Board of Viewers shall proceed to examine the land described in said petition, and other land if necessary to locate properly such improvement or improvements as are petitioned for, along the route described in petition or any other route answering the same purpose, if found more practicable or feasible, and may run levels such as may be necessary to determine the elevation of the several parts of the district, and shall make and return to the Clerk of the Superior Court, within thirty days, unless the time shall be extended by the court, a written report, which shall set forth:

1. Whether the proposed drainage is practicable or not;

2. Whether it will benefit the public health or any public highway or be conducive to the general welfare of the community;

3. Whether the improvement proposed will benefit the lands sought to be benefited;

4. Whether or not all the lands that are benefited are included in the proposed drainage district.

They shall also file with this report a map of the proposed drainage district, showing the location of the ditch or ditches or other improvement to be constructed and the lands that will be affected thereby, and such other information as they may have collected that will tend to show the correctness of their findings.

SEC. 4. FILING PRELIMINARY REPORT.—The Clerk of the Superior Court shall consider this report. If the viewers report that the drainage is not practicable or that it will not benefit the public health or any public highway or be conducive to the general welfare of the community, and the court shall approve such finding, the petition shall be dismissed at the cost of the petitioners. Such petition or proceeding may again be instituted by the same or additional landowners at any time after six months, upon proper allegations that conditions have changed or that material facts were omitted or overlooked.

If the viewers report that the drainage is practicable and that it will benefit the public health or any public highway, or be conducive to the general welfare of the community, and the court shall so find, then the court shall fix a day when the report will be further heard and considered.

SEC. 5. NOTICE.—If the petition is entertained by the court, notice shall be given by publication for two consecutive weeks in some newspaper of general circulation within the county or counties, if one shall be published in such counties, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places within the drainage district, that on the date set, naming the day, the court will consider and pass upon the report of the viewers. At least fifteen days shall intervene between the date of the publication and the posting of the notices and the date set for the hearing.

SEC. 6. HEARING PRELIMINARY REPORT.—At the date appointed for the hearing the court shall hear and determine any objections that may be offered to the report of the viewers. If it appear that there is any land within the proposed levee or drainage district that will not be affected by the leveeing or drainage thereof, such lands shall be excluded and the names of the owners withdrawn from such proceeding; and if it shall be shown that there is any land not within the proposed district that will be affected by the construction of the proposed levee or drain, the boundary of the district shall be so changed as to include such land, and such additional landowners shall be made parties plaintiff or defendant, respectively, and summons shall issue accordingly, as hereinbefore provided. After such change in the boundary is made, the sufficiency of the petition shall be verified, to determine whether or not it conforms to the requirements of the statute, as provided in section 2. The efficiency of the drainage or levees may also be determined, and if it appears that the location of any levee or drain can be changed so as to make it more effective, or that other branches or spurs should be constructed, or that any branch or spur projected may be eliminated, or other changes made that will tend to increase the benefits of the proposed work, such modification and changes shall be made by the court. The engineer and the other two viewers may attend this meeting and give any information or evidence that may be sought to verify and substantiate their report. If necessary, the petition, as amended, shall be referred by the court to the engineer and two viewers for further report.

The above facts having been determined to the satisfaction of the court, and the boundaries of the proposed district so determined, it shall declare the establishment of the drainage or levee district, which shall be designated by a name or number, for the object and purpose as herein set forth.

Sec. 7. May Condemn Land.—If it shall be necessary to acquire a right of way or an outlet over and through lands not affected by the drainage, and the same cannot be acquired by purchase, then and in such event the power of eminent domain is hereby conferred, and the same may be condemned. Such owner or owners of the land proposed to be condemned may be made parties defendant, and the procedure shall be substantially as provided for the condemnation of rights of way for railroads in chapter 61 of the Revisal of 1905, so far as the same may be applicable.

Sec. 8. Right of Appeal.—Any person or corporation owning lands within the drainage or levee district which he or it thinks will not be benefited by the improvement and should not be included in the district may appeal from the decision of the court to the Superior Court of such county, in term time, by filing an appeal, accompanied by a bond conditioned for the payment of the costs, if the appeal should be decided against him, for such sum as the court may require, not exceeding $200, igned by two or more solvent sureties or by some approved surety company, to be approved by the court.

Sec. 9. Complete Survey.—After the district is established, the court shall refer the report of the engineer and viewers back to them to make a complete survey, plans and specifications for the drainage or levees, and fix a time when said engineer and viewers shall complete and file their report, not exceeding sixty days.

Sec. 10. Complete Report.—The engineer and viewers shall have power to employ such assistants as may be necessary to make a complete survey of the drainage district, and shall enter upon the ground and make a survey of the main drain, or drains, and all its laterals. The line of each ditch, drain or levee shall be plainly and substantially marked on the ground. The course and distance of each ditch shall be carefully noted and sufficient notes made, so that it may be accurately platted and mapped. A line of levels shall be run for the entire work, and sufficient data secured, from which accurate profiles and plans may be made. Frequent bench-marks shall be established along the line on permanent objects and their elevation recorded in the field books. If it is deemed expedient by the engineer and viewers, other levels may be run to determine the fall from one part of the district to another. If an old water course, ditch or channel is being widened, deepened or straightened, it shall be accurately cross-sectioned, so as to compute the amount of cubic yards saved by the use of such old channel. A drainage map of the district shall then be completed, showing the location of the ditch or ditches and other improvements, and the boundary, as closely as may be determined by the records of the lands owned by each individual landowner within the district. The location of any railroads or public highways and the boundary of any incorporated towns or villages within the district shall be shown on the map. There shall also be prepared to accompany this map a profile of each levee, drain or water course, showing the surface of the ground, the bottom or grade of the proposed improvement and the number of cubic yards of excavation or fill in each mile or fraction thereof, and the total yards in the proposed improvement and the estimated cost thereof, and the cost of any other work required to be done.

Sec. 11. Assessment of Damages.—It shall be the further duty of the engineer and viewers to assess the damages claimed by any one that are justly right and due to them for land taken or for inconvenience imposed because of the construction of the improvement or for any other legal damages sustained. Such damage shall be considered separate and apart from any benefit the land would receive because of the proposed work.

Sec. 12. Classification of Land According to Benefits.—It shall be the further duty of the engineer and viewers to personally examine the land in the district and classify it with reference to the benefit it will receive from the construction of the levee, ditch, drain or water course or other improvement. In the case of drainage the degree of wetness of the land, its proximity to the ditch or a natural outlet and the fertility of the soil shall be considered in determining the amount of benefit it will receive by the construction of the ditch. The land benefited shall be separated into five classes. The land receiving the highest benefit shall be marked "Class A"; that receiving the next highest benefit, "Class B"; that receiving the next highest benefit, "Class C"; that receiving the next highest benefit, "Class D," and that receiving the smallest benefit, "Class E." The holdings of any one landowner need not necessarily be all in one class, but the number of acres in each class shall be ascertained, though its boundary need not be marked on the ground or shown on the map. The total number of acres owned by one person in each class and the total number of acres benefited shall be determined. The total number of acres of each class in the entire district shall be obtained and presented in tabulated form. The scale of assessment upon the several classes of land returned by the engineer and viewers shall be in the ratio of 1, 2, 3, 4 and 5—that is to say, as often as five mills per acre is assessed against the land in Class A four mills per acre shall be assessed against the land in Class B, three mills per acre in Class C, two mills per acre in Class D, and one mill per acre in Class E. This shall form the basis of the assessment of benefits to the lands for drainage purposes.

SEC. 13. COST OF THE SURVEY.—The engineer and viewers shall keep an accurate account and report to the court the name and number of days each person was employed on the survey and the kind of work he was doing, and any expenses that may have been incurred in going to and from the work, and the cost of any supplies or material that may have been used in making the survey.

SEC. 14. DELAY—EXTENSION OF TIME.—In case the work is delayed by high water, sickness or any other good cause, and the report is not completed at the time fixed by the court, the engineer and viewers shall appear before the court and state in writing the cause of such failure, and ask for sufficient time in which to complete the work, and the court shall set another date, by which the report shall be completed and filed.

SEC. 15. FINAL REPORT—NOTICE OF HEARING.—When the final report is completed and filed, it shall be examined by the court, and if it is found to be in due form and in accordance with the law, it shall be accepted, and if not in due form, it may be referred back to the engineer and viewers, with instruction to secure further information, to be reported at a subsequent date, to be fixed by the court. When the report is fully completed and accepted by the court, a date shall be fixed by the court for the final hearing upon the report, not less than twenty days, and notice thereof given by publication in a newspaper of general circulation in the county and by posting a written or printed notice on the door of the courthouse and at five conspicuous places throughout the district, such publication to be made for at least two weeks before the final hearing. During this time a copy of the report shall be on file in the office of the Clerk of the Superior Court and shall be open to the inspection of any landowner or other person interested within the district.

Sec. 16. Adjudication—Final Report.—At the date set for hearing, any landowner may appear in person or by counsel and file his objection in writing to the report of the viewers; and it shall be the duty of the court to carefully review the report of the viewers and the objections filed thereto, and make such changes as are necessary to render substantial and equal justice to all the landowners in the district. If, in the opinion of the court, the cost of construction, together with the amount of damages assessed, is not greater than the benefits that will accrue to the land affected, the court shall confirm the report of the viewers. If, however, the court finds that the cost of construction, together with the damages assessed, is greater than the resulting benefit that will accrue to the lands affected, the court shall dismiss the proceedings at the cost of the petitioners, and the sureties upon the bond so filed by them shall be liable for such costs: *Provided*, that the State Geological and Economic Survey may remit and release to the petitioners the costs expended by said board on account of the engineer and his assistants. The court may from time to time collect from the petitioners such amounts as may be necessary to pay costs accruing, other than costs of the engineer and his assistants, such amounts to be repaid from the special tax hereby authorized.

Sec. 17. Appeal.—Any party aggrieved may, within ten days after the confirmation of the assessor's report, appeal to the Superior Court in term time. Such appeal shall be taken and prosecuted as now provided in appeals in special proceedings.

Sec. 18. Drainage Record.—The Clerk of the Superior Court shall provide a suitable book, to be known as the Drainage Record, in which he shall transcribe every petition, motion, order, report, judgment or finding of the court in every drainage transaction that may come before it in such a manner as to make a complete and continuous record of the case. Copies of all the maps and profiles are to be furnished by the engineer and marked by the clerk "Official Copies," which shall be kept on file by him in his office, and one other copy shall be pasted or otherwise attached to his record book.

SEC. 19. After the said drainage district shall have been declared established, as aforesaid, and the survey and plans therefor approved, the court shall appoint three persons, who shall be disinterested, as "The Board of Drainage Commissioners." Such drainage commissioners shall first be elected by the owners of land within the drainage or levee district, or by a majority of same, in such manner as the court shall prescribe. The court shall appoint those receiving a majority of the votes. If any one or more of such proposed commissioners shall not receive the vote of a majority of such landowners, the court shall appoint all or the remainder from among those voted for in the election. Any vacancy thereafter occurring shall be filled in like manner. Such three drainage commissioners, when so appointed, shall be immediately created a body corporate, under the name and style of "The Board of Drainage Commissioners of ——— District," with the right to hold property and convey the same, to sue and be sued, and shall possess such other powers as usually pertain to corporations. They shall organize by electing from among their number a chairman and a vice-chairman. They shall also elect a secretary, either within or without their body. The treasurer of the county in which the proceeding was instituted shall be *ex officio* treasurer of such drainage commissioners. Such Board of Drainage Commissioners shall adopt a seal, which they may alter at pleasure.

The Board of Drainage Commissioners shall have and possess such powers as are herein granted. The name of such drainage district, whether designated by number or otherwise, shall constitute a part of its corporate name; for illustration, "The Board of Drainage Commissioners of (No. 1, or Moyock) District."

SEC. 20. SUPERINTENDENT OF CONSTRUCTION.—The Board of Drainage Commissioners shall appoint a competent person as superintendent of construction. Such person shall furnish a bond, to be approved by the commissioners, in the penal sum of $10,000, conditioned upon the honest and faithful performance of his duties, such bond to be in favor of the Board of Drainage Commissioners.

SEC. 21. NOTICE OF LETTING CONTRACT—BOND.—The Board of Drainage Commissioners shall cause notice to be given for two consecutive weeks in some newspaper published in the county wherein such improvement is located, if such there be, and such additional publication elsewhere as they may deem expedient, of the time and place of letting the work of construction of said improvement, and in such notice they shall specify the approximate amount of work to be done and the time fixed for the completion thereof; and on the date appointed for the letting, they, together with the superintendent of construction, shall convene and let to the lowest responsible bidder, either as a whole or in sections, as they may deem most advantageous for the district, the proposed work. No bid shall be entertained that exceeds the estimated cost, except for good and satisfactory reasons it shall be shown that the original estimate was erroneous. They shall have the right to reject all bids and advertise again the work, if in their judgment the interests of the district will be subserved by doing so. The successful bidder shall be required to enter into a contract with the Board of Drainage Commissioners and to execute a bond for the faithful performance of such contract, with sufficient sureties, in favor of the Board of Drainage Commissioners, for the use and benefit of the levee or drainage district, in an amount equal to 25 *per centum* of the estimated cost of the work awarded to him.

SEC. 22. The superintendent in charge of construction shall make monthly estimates of the amount of work done and furnish one copy to the contractor and file the other with the secretary of the Board of Drainage Commissioners; and the commissioners shall, within five days after the filing of such estimate, meet and direct the secretary to draw a warrant in favor of such contractor for 90 *per centum* of the work done, according to the specifications and contract; and upon the presentation of such warrant, properly signed by the chairman and secretary, to the treasurer of the drainage fund, he shall pay the amount due thereon. When the work is fully completed and accepted by the superintendent, he shall make an estimate for the whole amount due, including the amounts withheld on the previous monthly estimates, which shall be paid from the drainage fund, as before provided.

SEC. 23. FAILURE OF CONTRACTOR—RELETTING.—If any contracto to whom a portion of said work shall have been let shall fail to perfor the same according to the terms specified in his contract, action may b had in behalf of the Board of Drainage Commissioners against suc contractor and his bond in the Superior Court for damages sustained b the levee or drainage district, and recovery made against such contracto and his sureties. In such an event the work shall be advertised and rele in the same manner as the original letting.

SEC. 24. RIGHT OF CONTRACTOR.—In the construction of the wor the contractor shall have the right to enter upon the lands necessary fo this purpose, and the right to remove private or public bridges or fence and to cross private lands in going to or from the work. In case th right of way of the improvement is through timber, the owner thereo shall have the right to remove it, if he so desires, before the work o construction begins, and in case it is not removed by the landowner shall become the property of the contractor and may be removed by hi

SEC. 25. HIGHWAYS AFFECTED.—Where any public ditch, drain or water course established under the provisions of this act crosses a public highway, the actual cost of constructing the same across the highway or removing old bridges or building new ones shall be paid for from the fund of the drainage district. Wherever any highway within the levee or drainage district shall be beneficially affected by the construction of any improvement or improvements in such district, it shall be the duty of the viewers appointed to classify the land, to give in their report the amount of benefit to such highway, and notice shall be given by the Clerk of the Superior Court to the clerk of the Board of County Commissioners in the county where the road is located of the amount of such assessment, and the county commissioners shall have the right to appear before the court and file its objections, the same as any landowner.

SEC. 26. RAILROAD—DAMAGE—BENEFIT.—Whenever the engineer and the viewers in charge shall make a survey for the purpose of locating a public levee or drainage district or changing a natural water course, and the same would cross the right of way of any railroad company, it shall be the duty of the viewers in charge of the work to notify the railroad company by serving written notice upon the agent of such company or its lessee or receiver that they will meet the company at the place where the proposed ditch, drain or water course crosses the right of way of such company, said notice fixing the time of such meeting shall not be less than ten days after the service of the same, for the purpose of conferring with said railroad company with relation to the place where and the manner in which such improvement shall cross such right of way. When the time shall arrive fixed for such conference, unless for good cause more time is agreed upon, it shall be the duty of the viewers in charge and the railroad company to agree, if possible, upon the place where and the manner and method in which such improvement shall cross such right of way. If the viewers in charge and the railroad company cannot agree, or if the railroad company shall fail, neglect or refuse to confer with the viewers, they shall determine the place and manner of crossing the right of way of said railroad company, and shall specify the number and size of openings required, and the damages, if any, to said railroad company, and so specify in their report. The fact that the railroad company is required by the construction of the improvement to build a new bridge or culvert, or to enlarge or strengthen an old one, shall not be considered as damages to said railroad company. The engineer and viewers shall also assess the benefits that will accrue to the right of way, roadbed and other property of said company by affording better drainage or a better outlet for drainage, but no benefits shall be assessed because of the increase in business that may come to said road because of the construction of the improvement. The benefits shall be assessed as a fixed sum, determined solely by the physical benefit that its property will receive by the construction of said improvement, and it shall be reported by the viewers as a special assessment, due personally from the railroad company; and unless the same is paid when due by the company as a special assessment, it may be collected in the manner of an ordinary debt in any court having jurisdiction.

SEC. 27. NOTICE TO RAILROAD.—The Clerk of the Superior Court shall have notice served upon the railroad company of the time and place of the meeting to hear and determine the final report of the engineer and viewers, and the said railroad company shall have the right to file objections to said report and to appeal from the findings of the board of commissioners in the same manner as any landowner, but such an appeal shall not delay or defeat the construction of the improvement.

SEC. 28. MANNER OF CROSSING RIGHT OF WAY—PENALTY FOR DELAY—COST.—After the contract is let and the actual construction is commenced, if the work is being done with a floating dredge, the superintendent in charge of construction shall notify the railroad company of the probable time at which the contractor will be ready to enter upon the right of way of said road and construct the work thereon. It shall be the duty of said railroad to send a representative to view the ground with the superintendent of construction, and arrange the exact time at which such work can be most conveniently done. At the time agreed upon, the said railroad company shall remove its rails, ties, stringers and such other obstructions as may be necessary to permit the dredge to excavate the channel across its right of way. The work shall be so planned and conducted as to interfere in the least possible manner with the business of said railroad.

In case the railroad company refuses and fails to remove its track and allow the dredge to construct the work on its right of way, it shall be held as delaying the construction of the improvement, and such company shall be liable to a penalty of $25 per day for each day of delay, to be collected by the Board of Drainage Commissioners for the benefit of the drainage district, as in the case of other penalties. Such a fine may be collected in any court having jurisdiction, and shall inure to the benefit of the drainage district. Within thirty days after the work is completed, an itemized bill for the actual expenses incurred by the railroad company for opening its tracks shall be made and presented to the superintendent of construction of the drainage improvement. Such bill, however, shall not include the cost of putting in a new bridge or strengthening or enlarging an old one. The superintendent of construction shall audit this bill and, if found correct, approve the same and file it with the secretary of the Board of Drainage Commissioners. The commissioners shall deduct from this bill the cost of the excavation done by the dredge on the right of way of said railroad company at the contract price, and pay the difference, if any, to said railroad company.

SEC. 29. CONTROL AND REPAIRS.—Whenever any improvement constructed under this act is completed, it shall be under the control and supervision of the Board of Drainage Commissioners. It shall be the duty of the said board to keep the levee, ditch, drain or water course in good repair, and for this purpose they may levy an assessment on the lands benefited by the construction of such improvement in the same manner and in the same proportion as the original assessments were made, and the fund that is collected shall be used for repairing and maintaining the ditch, drain or water course in perfect order: *Provided, however,* that if any repairs are made necessary by the act or negligence of the owner of any land through which such improvement is constructed, or by the act or negligence of his agent or employee, or if the same is caused by the cattle, hogs or other stock of said owner, employee or agent, then the cost thereof shall be assessed and levied against the lands of said owner alone, to be collected by proper suit instituted by the drainage commissioners.

It shall be unlawful for any person to injure or damage or obstruct or build any bridge, roadway, fence or floodgate in such a way as to injure or damage any levee, ditch, drain or water course constructed or improved under the provisions of this act, and any person causing such injury shall be guilty of a misdemeanor, and upon conviction thereof may be fined in any sum not exceeding twice the damage or injury done or caused.

SEC. 30. OUTLET FOR LATERAL DRAINS.—The owner of any land that has been assessed for the cost of the construction of any ditch, drain or water course as herein provided shall have the right to use the ditch, drain or water course as an outlet for lateral drains from said land; and if said land is separated from the ditch, drain or water course by the land of another or others, and the owner thereof shall be unable to agree with said other or others as to the terms and conditions on which he may enter their lands and construct said drain or ditch, he may file his ancillary petition in such pending proceeding to the court, and the procedure shall be as now provided by law. When the ditch is constructed it shall become a part of the drainage system and shall be under the control of the Board of Drainage Commissioners and kept in repair by them as herein provided.

SEC. 31. ASSESSMENT TAX ROLL.—After the classification of the land and the ratio of assessment of the different classes to be made thereon has been confirmed by the court, the drainage commissioners shall prepare an assessment roll or drainage tax duplicate, giving a description of all the land in said drainage district, the name of the owner, so far as can be ascertained from the public records, and the amount of assessment against each of the several tracts of land.

In preparing this assessment roll the board shall ascertain the total cost of the improvement, including the damages awarded and paid to the owners of land, and all incidental expenses, and deduct therefrom any special assessment made against any railroad or highway, and the remainder shall be the amount to be borne and paid by the lands benefited. This amount shall be assessed against the said tracts of land according to the benefit received, as shown by the classification and ratio of assessment made by the viewers and confirmed by the Board of County Commissioners.

This drainage tax roll shall be made in duplicate, signed by the chairman and secretary, and one copy filed with the drainage record and the other delivered to the sheriff or other county tax collector. There shall be appended an order to collect the said assessments, and the same shall have the force and effect of a judgment, as in the case of State and county taxes.

SEC. 32. TIME OF PAYMENT.—If the total cost of the work is less than an average of 25 cents per acre on all the land in the district, the assessment made against the several tracts shall be collected in one installment by the same officer and in the same manner as State and county taxes are collected, and payable at the same time. In case the total assessment exceeds the average of 25 cents per acre on all the lands in the district, the said Board of Drainage Commissioners may give notice of three weeks, by publication in some newspaper of general circulation in the district, that they propose to issue bonds for the construction of said improvement, giving the amount of bonds to be issued, the rate of interest they are to bear and the time when payable. Any landowner having lands assessed in the district and not wanting to pay interest on the bonds may, within thirty days after the publication of said notice, pay the County Treasurer the full amount of his assessment and have his land released therefrom.

SEC. 33. DEFENSE—WAIVER.—Each and every person owning land in the district which is assessed for the construction of an improvement, who shall neglect or fail to pay the full amount of his assessment to the County Treasurer within the time specified, shall be deemed as consenting to the issuing of said drainage bonds, and in consideration of the right to pay his assessment in installments he hereby waives his right to any defense against the collection of said assessment because of any irregularity, illegality or defect in the proceedings prior to this time, except in the case of an appeal, as heretofore provided, which is not affected by this waiver. The term "person," as used in this act, includes any firm, company or corporation.

SEC. 34. BOND ISSUE.—At the expiration of the thirty days after the publication the Board of Drainage Commissioners may issue bonds for the full amount of the assessment not paid in to the County Treasurer, together with the interest thereon, costs of collection or other incidental expenses. These bonds shall bear 6 per cent. interest per annum, payable annually, and shall be paid in ten equal annual installments. The first installment of the principal shall mature at the expiration of three years from the date of issue, and one installment each succeeding year for nine additional years. The commissioners may sell these bonds at not less than par and devote the proceeds to the payment of the work as it progresses. In no case shall bonds be issued until the tax levy has been made to meet them as they come due. The bonds issued shall be for the exclusive use of the levee or drainage district specified on their face, and should be numbered by the Board of Drainage Commissioners and recorded in the drainage record, which record shall set out specifically the lands embraced in the district on which the tax has not been paid in full, and which land is assessed for the payment of the bonds issued and the interest thereon.

This assessment shall constitute the first and paramount lien, second only to State and county taxes, upon the lands assessed for the payment of said bonds and the interest thereon as they become due, and shall be collected in the same manner by the same officers as the State and county taxes are collected. The official bonds of the tax collector and County Treasurer shall be liable for the faithful performance of the duties herein assigned them. Such bonds may be increased by the Board of County Commissioners.

SEC. 35. RE-LEVY.—Where the court has confirmed an assessment for the construction of any public levee, ditch or drain, and such assessment has been modified by the court of superior jurisdiction, but for some unforeseen cause it cannot be collected, the Board of Drainage Commissioners shall have power to change or modify the assessment as originally confirmed to conform to the judgment of the Superior Court; and to cover any deficit that may have been caused by the order of said court or unforeseen occurrence, the said re-levy shall be made for the additional sum required in the same ratio on the lands benefited as the original assessment was made.

Sec. 36. Fees and Expenses.—Any engineer employed under the provisions of this act shall receive such compensation per diem for his services as shall be fixed and determined by the court. The viewers, other than the engineer, shall receive $3 per day; the rodmen, axemen, chainmen and other laborers shall receive $2 per day each. All other fees and costs incurred under the provisions of this act shall be the same as provided by law for like services in other cases. Said costs and expenses shall be paid by the order of the court out of the drainage fund provided for that purpose, and the Board of Drainage Commissioners shall issue warrants therefor when funds shall be in the hands of the treasurer.

Sec. 37. Defects in Proceedings.—The provisions of this act shall be liberally construed to promote the leveeing, ditching, draining and reclamation of wet and overflowed lands. The collection of the assessment shall not be defeated, where the proper notices have been given, by reason of any defect in the proceedings occurring prior to the order of the court confirming the final report of the viewers; but such order or orders shall be conclusive and final that all prior proceedings were regular and according to law, unless they were appealed from. If, on appeal, the court shall deem it just and proper to release any person or to modify his assessment or liability, it shall in no manner affect the rights and legality of any person other than the appellant, and the failure to appeal from the order of the court within the time specified shall be a waiver of any illegality in the proceedings, and the remedies provided for in this act shall exclude all other remedies.

Sec. 38. Proceedings under this act may be *ex parte* or adversary. Any engineer, viewer, superintendent of construction or other person appointed under this act may be removed by the court, upon petition, for corruption, negligence of duties or other good and satisfactory cause shown.

Sec. 39. All laws in conflict with this act are hereby repealed.

Sec. 40. This act shall be in effect from and after its ratification.

As explanatory to certain sections of this recommended legislation, the following paper that has been prepared by Mr. J. O. Wright, is attached to the record of the convention.

THE ASSESSMENT OF BENEFITS AND DAMAGES IN A PUBLIC DRAINAGE DISTRICT.

BY J. O. WRIGHT.

By the drainage of wet lands, there are two classes of benefits created: (1) The benefit that accrues to the land itself by making it more productive and thereby increasing its commercial value; and (2) a benefit that comes to the community at large by improving the public health, convenience and welfare. The first of these is a private matter and the second a public utility. It is because of this latter function that drainage laws are enacted. The Supreme Court of Indiana in Tillman *vs.* Kircher, 64, Indiana, page 104, has held that "the legislature cannot constitutionally enact any law authorizing one person to improve the lands of another by means of drainage and compel the person benefited to pay to the other an assessment therefor, unless the public health is also in some way benefited thereby, as that the drainage is necessary and is conducive to the public health, convenience, or welfare, or a public benefit or utility, and then it can be done only by due course of law." If, therefore, it is proposed to establish a drain that is of great benefit to one or more landowners and there is nothing pertaining to public health, use, convenience, or welfare, such a drain could not be constructed across the lands of another, even by paying for the privilege, without his consent, and any law purporting to give such right would be unconstitutional, null and void. So, the fundamental idea then on which all drainage laws are based is that drainage is a public function and not a private enterprise.

Again, drainage is of such a character that it cannot be carried to any great extent without some form of co-operation. Frequently the wet area is large and one landowner cannot drain his land without affecting those of another. The question whether or not one or more landowners can compel an individual against his will to bear a portion of the expense of a drain for the common good reaches to the foundation of our civil government. By what authority can one man or any number of men say to another that "we propose to drain a certain area of land, a part of which you own and you shall pay your share of the expense?" The only ground for such authority must be his consent, either expressed or implied. When one becomes a citizen of the State, either by birth or adoption, there are certain things he tacitly agrees to do or consents to having done, such as sharing in the administrative expense of the government to construct and maintain certain highways, to build and support public schools, to establish and maintain benevolent and penal institutions, and to do and suffer many things for the common good. These and many other burdens to be borne by the citizens of the State should be equal and uniform. A citizen may remain on his own premises and not use a public highway yet he must pay a road tax. He may have no children to educate, yet he must pay a school tax. He may have no need for the insane asylum, still he is taxed to support it. In such matters, man is viewed as a part of the community and a citizen of the State and not as an individual. He still possesses certain rights, but they are held subservient to the common good.

Our governments, both State and National, have recognized that drainage is for the common good and every individual landowner must contribute his just proportion to its construction. In order to secure this end practically all the States have passed some form of a drainage law based on the above fundamental principles. These laws very justly recognize that the individuals have certain rights that must be respected, as well as certain obligations that must be enforced. The first of these rights is that private property may not be taken for public use without due process of law and after just compensation has been paid or secured. Under this constitutional provision, commonly called the right of eminent domain the land may be condemned for a public highway or for a public drain. Although the improvement may not be used by the community at large, if it serves all the people of that particular locality, be they few or many, it is held to be of public use and is not opposed to the constitution.

DAMAGES.

The damages that may result from the establishment and construction of a public drain are:

1. For the land actually appropriated and used for the construction of an open ditch or drain. If the improvement consists of widening and deepening a channel that already exists, the courts in some States have held that no damage should be allowed. That being the natural course of the water, the owner of the land is bound to furnish such additional right of way as might become necessary by development and improvement of the natural watershed. If, however, the improvement involves the cutting off of bends and the digging of new channels where none exists, or the cutting through of ridges and diverting the water that formerly flowed in some other course, then a fair market value must be paid to the owner for the land so appropriated for use for the common good.

2. If, by the construction of an open ditch or drain, the arable land is cut up so as to increase the cost of cultivation and harvesting of the crops, or a bridge is required so as to get from one part of the field to another, then these facts should be taken into consideration and a reason-

able damage allowed for such additional expense as the owner will be compelled to incur, but nothing should be allowed for fanciful inconvenience.

3. When an open ditch passes through a forest, it is desirable to have the timber removed for a short distance on each side to prevent the leaves and twigs from falling in and obstructing the ditch. In such case the owner should be permitted to remove the timber at his own expense for his own benefit, or it should be appraised standing and paid for and removed by the drainage district. In all such cases the actual cash value of the property taken or destroyed should be determined by competent viewers after an inspection of the premises and a fair and reasonable value allowed for the same.

DAMAGES TO RAILROADS AND HIGHWAYS.

If, in the construction of a drainage system, any railroad or public highway should be damaged, it should be compensated for such damages. But the instances are very rare in which such damage will occur. It was formerly held that if in the construction of a ditch crossing a railroad or highway it became necessary to enlarge the waterway or build a new bridge that such expense was a damage, but a recent ruling of the Supreme Court has changed this doctrine. The Supreme Court of the United States, affirming the decision in the case of the C. B. & Q. Railroad Company *vs.* the Commissioner of Drainage District No. 1, Bristol Township, Kendall County, Ill., 212 Ill., p. 103, sets forth the law governing cases of this kind as follows:

> When the railroad company laid the foundations of its bridge in Rob Roy Creek it did so subject to the rights of the public in the use of that watercourse, and also subject to the possibility that new circumstances and future public necessities might, in the judgment of the State, reasonably require a material change in the methods used in crossing the creek with cars. It may be—and we take it to be true—that the opening under the bridge as originally constructed was sufficient to pass all the water then or now flowing through the creek. But the duty of the company, implied in law, was to maintain an opening under the bridge that would be adequate and effectual for such an increase in the volume of water as might result from lawful, reasonable regulations established by appropriate public authority from time to time for the drainage of lands on either side of the creek. . . . . The great weight of authority is that where there is a natural waterway, or where a highway already exists and is crossed by a railroad company under its general license to build a railroad, and without any specific grant by the legislative authority to obstruct the highway or waterway, the railway company is bound to make and keep its crossing, at its own expense, in such condition as shall meet all the reasonable requirements of the public as the changed conditions and increased use may demand. . . . . The duty of a railroad to restore a stream or highway which is crossed by the line of its road is a continuing duty; and if,

by the increase of population or other causes, the crossing becomes inadequate to meet the new and altered conditions of the country, it is the duty of the railroads to make such alterations as will meet the present needs of the public. . . . . The duty of the new company will end when it removes the obstructions which it has placed in the way of enlarging, deepening, and widening the channel. It follows, upon principles of justice, that while the expense attendant upon the removal of the present bridge and culvert and the timbers and stones placed by the company in the creek, as well as the expense of the erection of any new bridge which the company may elect to construct in order to conform to the plan of the commissioners, should be borne by the railway company, the expense attendant merely upon the removal of soil in order to enlarge, deepen, and widen the channel must be borne by the district.

If, however, the work is to be done by a dredge boat and a railroad company is required to open its tracks, as it should be to promote the passage of the boat, the necessary expense incurred is a damage to the railroad company and it should be reimbursed for such outlay. The same is true concerning the bridges of a public highway. If it should be necessary to remove them to facilitate the construction of the ditch, the work should be done by the proper authorities and not by the contractor, and just compensation should be made for the same. In some instances a ditch parallels a highway and the excavated material is placed on it to increase the height of the grade or embankment. While this is being done it is often necessary to provide a temporary road to accomodate the travel and such work is an expense or damage to the highway commissioners and they should be allowed a reasonable compensation for such damages. The damages to the landowner and to the railroads and highways should be viewed and considered separate and apart from any benefits that they may receive from the construction of the work. In fact, I think it would be good practice to have the damages estimated and determined by one set of viewers and the benefits by a different set. In this way it would be possible to fairly separate the two so that the assessment of one would not affect the other. When the damages are ascertained they should be added to the cost of excavation, together with the legal and administrative expenses, to form the total cost of the work.

ASSESSMENT OF BENEFITS.

It is a fundamental principle of most drainage laws that a public drain will not be established unless the benefits resulting from its construction exceed the total cost of the work. It is generally conceded that the persons receiving the benefits should pay for the cost of the improvement. This seems to be a just and fair proposition, but the difficulty arises in distributing this cost among the several beneficiaries. From a wide personal knowledge throughout many States and from published articles on the subject, the writer is convinced that there is no definite method in vogue for apportioning this cost, and the results are not uniform. In presenting a map of the drainage district with a full description as to location and character of the land to different engineers and drainage commissioners requesting them to indicate the relative amount of assessment on certain tracts, the results vary exceedingly. The several amounts seem to be something of a guess and in some instances poor guessing is done. The writer has known viewers to pass over the land and say that this tract should be assessed so many dollars, the next one some given amount, and the third still a different amount, without reference to any fixed system or method of determining the several amounts thus placed on the different tracts. This great diversity in the results obtained is either because a law on the subject is indefinite and uncertain or else its provisions are not well understood. In a few of the States, as Louisiana and Florida, the drainage laws provide for a fixed sum per acre assessed uniformly on all the land in the district. This method is manifestly unjust and it will be but a few years until the laws in these States are modified and the plan placed on a more rational basis. In most of the States, however, the law provides that the assessment shall be in proportion to the benefits received from the construction of the proposed improvement. In the drainage law of Indiana, acts of 1907, page 515, the third cause for remonstrance "By any person or persons whose lands are assessed as benefited, that his or their lands are assessed too much as compared with other lands assessed as benefited or damaged, specifying the same." And, fourth, cause "By any person or persons whose lands are assessed as benefited, that other tracts specifying the same, are assessed too low according to the benefits to be received."

This principle, though differently expressed, is the gist of most of the State laws on the subject of drainage. The Supreme Court of Indiana has repeatedly held that the land must be assessed in proportion to the benefits received. This being the law, the question for us to consider is: How shall we determine the relative amount of benefits the several tracts of land in a drainage district will receive from the proposed improvement?

There are certain inherent attributes in all land which affect its value. Some of these can be modified by the construction of a ditch or drain and some cannot. If the construction of a proposed improvement affects these attributes so as to benefit the land, they should be taken into consideration in the assessment of benefits, but if they are of a nature as not to be affected by the construction of the ditch or drain, then they should have no weight in making the assessment. These attributes are:

1. Absolute location.
2. Relative position.
3. Degree of wetness.
4. Fertility of the soil.
5. Character of the surface.
6. General healthfulness.

The first of these—*the location of the tract*—cannot be affected by the construction of the ditch or drain. If one portion of marsh is near a railroad station or a large city so as to have ready transportation and a good market, and another portion is situated at a remote distance and each were reclaimed by a system of drainage, the former would be of much more value to its owner because of this nearness to market, than the latter, but this increase would be due to its location and not to the effects of drainage. The two tracts, if cultivated in the same crop, might produce the same amount of vegetables or grain. This would show them to be equal in productive power. A crop on the tract nearest the market or railroad might net its owner several times more than the other, but this increased market value would not be due to the effect of drainage but to the location of the land with reference to the market. The location of the land has nothing to do with the quantity of the crop that the land will produce after the improvement is made, but affects solely cost of marketing such a crop. One piece of the land might be better cultivated or planted in a crop having a higher commercial value than another, but this would not be due to the construction of the improvement and should not be taken into account in assessing the benefits.

Relative Position.—By relative position is meant the relation the several tracts of land bear to each other and to the outlet as furnished by the proposed improvement, and not some outlet which already exists. The drainage laws of practically all the States say that the land shall be assessed according to the benefits received by the construction of some specific improvement. It is not, therefore, to be assessed for the benefit received for some improvements which already exist. If a given trac of land is no nearer an adequate outlet when the ditch is completed than before, it should not be assessed for the construction. If, however, th proposed ditch brings an adequate outlet to the land or closer to it than it was before, it should be assessed accordingly. Even if a tract of land lies back several rods from the improvement and has no water removed from it by the construction of the ditch or drain, it is benefited insomuch as the outlet is brought nearer to it than it was before the ditch wa constructed; hence proximity of the land to the ditch is an element to b considered in assessing the benefits. It must be borne in mind, however, that the law says the assessment shall be according to the benefits received and not according to the cost of securing them. Two pieces of land situated in the same drainage district may by the construction of a drain receive equal benefits, but because it costs more to bring these benefits to one of these tracts than to the other it should not be assessed higher than the other. In many places it is customary for the viewers to place a lower assessment on land near the mouth of the ditch than on similar land receiving the same amount of benefits from the construction of the proposed drain situated nearer the upper end of the ditch. This is contrary to the provision of the statute and is not in accordance with the recognized practice of assessing benefits. It is the relative amount of benefits secured and not the cost of securing them that must be taken into consideration. In an assessment for street improvement in a city, all of the lots fronting on the street are assessed equal amounts per front foot. One end of this street, however, may be level, requiring a large amount of excavation. In such case it costs much more to improve the street in front of a lot on one end of the street than on the other, yet they are taxed the same amount per front foot because they are each supposed to receive the same amount of benefit from the improvement of the street.

Under the drainage laws as now framed this same principle must prevail. Each tract of land must be taxed in proportion to the amount of benefit it receives from the construction of the ditch or drain and not because it is nearer the outlet than some other tract, and hence can secure this benefit at a lesser cost. If the land already has an outlet, it will not be benefited and should not be included in the district. The land at the lower end of the drainage district near the outlet is usually drier than that farther up and would not be taxed so much for this reason but if the lands are of a like character in other respects, both as to kind and degree, there will be no difference in the benefits received because one tract happens to lie farther up the ditch from the outlet than the other. The only exception that should be made from this general statement is in case of a tract lying near the natural outlet so that it may be drained independently of the drainage district at a less cost than would be assessed against it if included in the drainage district. In such case it might have a reduction in its assessment because of its location as a matter of equity but not because the drainage law authorizes it.

Degree of Wetness.—The next element and by far the most important one which enters into the determination of the benefits is the degree of wetness. This may vary all the way from an absolute swamp at all times of the year to land that is too wet for cultivation at certain seasons, and since the primary object of drainage is to remove the excess of moisture and render the land fit for cultivation at all times and seasons, the degree of wetness or the amount of moisture to be removed is a matter that should receive the closest and most discriminating attention. If a 40-acre tract is not all of equal wetness it will often be found advantageous to subdivide it into two or more parts so as to get the number of acres representing the varying degrees of wetness.

Fertility of the Soil.—Another element which should not be lost sight of in making this classification is the fertility of the soil. Lands in the proposed district may be of an equal degree of wetness, may have the same elevation, and be situated the same distance from the proposed ditch and yet not receive the same amount of benefits from the construction of the improvement. It is not uncommon to find in the same marsh tracts of rich, black, alluvial soil and others of a whitish clay substance devoid of fertility and frequently known as sand flats. In such a case the fertile land would be greatly enhanced in value by proper drainage, while the other would be worth but little, even when drained. This is an extreme case, but in practically every drainage district there is a wide difference in the fertility of the soil, and the soil that is most fertile will as a rule be most benefited by drainage.

Condition of the Surface.—Some tracts possess a uniform, smooth surface, while others are traversed by old channels, rock-ledges, coulees, and crooked bayous, and even when drained all of the surface cannot be put in cultivation. This, however, is a condition not likely to be changed by drainage, and should not be taken into account in assessing the benefits. If the surface of the land is cut up or marred by the construction of the improvement, this is a proper matter to be considered in the assessment of damage but not the benefits.

Healthfulness.—Experience throughout the country has proven beyond a doubt that drainage improves the healthfulness of the community. It renders less prevalent disease of a malarious type and makes fit for habitation lands that otherwise could not be occupied. Wherever large areas of swamp lands have been drained the general healthfulness of the locality has been improved, and as a consequence, the market value of the land is increased. This is the result of the drainage of the land and should be taken into account in making the assessment of benefits.

The natural attributes of the land which are clearly changed by drainage are:

1. Degree of wetness.
2. Proximity to the ditch.
3. Fertility of the soil.
4. Conditions as to healthfulness.

These factors are not of equal importance in determining the assessment, so in order to get some plan that will produce a just and equitable result, it is suggested that the degree of wetness be given a value ranging from 0 to 40 points; that proximity be given a value ranging from 0 to 30 points; that fertility of the soil be given a value of 0 to 20 points; and general healthfulness a value of 0 to 10 points. Thus, in making a classification, the viewers would mark the wettest piece of land in the district 40 points, and all others having the same degree of wetness the same amount, while others having a lesser degree of wetness would be marked in points corresponding to their degree of wetness as compared with the first tract.

If some tract is adjacent to the ditch or the ditch passes through it, it would be marked 30 points for proximity; while other tracts would have a correspondingly less number of points, depending upon their distance from the ditch. If this first tract were extremely fertile, it would be marked 20 points on the basis of fertility, while a less fertile tract would be marked lower in a corresponding ratio. If it is thought that the proposed work will improve the sanitary conditions of one part of the district more than another, then the land would be marked from 0 to 10, according to the degree of benefits to the health that the viewers might think it would receive. When the several tracts are viewed and the points of benefit marked against them the total against each tract will be anywhere for 0 to 100 points, which will represent the relative amount of benefits each tract should be assessed for the construction of the proposed improvement.

The map shown represents a proposed drainage district. The wet area comprises the greater part of the township and has a good natural outlet in Juniper Creek on the south. The elevation of the surface is shown by the contour lines. The center of the tract is an open marsh having a sluggish current flowing in times of high water in a tortuous course towards the river. The channel near the river is well defined but must be made much deeper to afford an adequate outlet to drain the marsh. The land near the outer edge of the district is in cultivation, but is too wet to produce good crops and has not sufficient outlet for tile drainage. The character of the land is indicated by the symbols on the map. The soil is a deep, black loam, underlaid with clay except portions in sections 22, and 23, which is a fine, white, sandy clay with little or no vegetable matter in it. The black land is extremely fertile and when drained will be very productive, while the white clay land is lacking in fertility and will require special treatment to bring about any great degree of productiveness.

On this statement of facts it is proposed to classify this land and assess the benefits for the construction of a proposed drain, as indicated on the map. The ditch will follow the general course indicated and will be deep enough to afford an outlet to thoroughly drain every part of the district.

In accordance with the suggestions above made, we will select four tracts of land located in different parts of the district and mark them respectively A, B, C, and D, and classify them so as to make an assessment for their part of the cost of the ditch in proportion to the benefits received from its construction. We will first examine these tracts with reference to their degree of wetness. The northeast quarter of section 8, marked A, being in the center of a slough, is practically covered with water all the year and therefore possesses the highest degree of wetness, so we will mark it 50 points. The southeast quarter of section 15, marked B, is almost as wet as A, but has a slightly defined channel through it, so we will mark it 35 points. The southeast quarter of section 22, marked C, lies at a greater elevation, a portion of it being comparatively dry, so we will mark it 15 points. The southeast quarter of section 33, marked D, is nearer the river, and the natural outlet has a little better natural drainage and is not so wet as tracts A and B, so we will mark it 20 points.

Now we will view these same tracts with reference to their proximity to the ditch. In other words, we wish to note whether by the construction of this ditch they are brought any nearer to an adequate outlet. Tract A has the ditch brought within a few rods of it, and we will therefore mark it 28 points. The main outlet is improved and deepened and brought nearer to tract B, but an additional ditch will have to be dug before advantage can be taken of this outlet, so we will mark it on proximity 15 points. Tract C, being still farther away, will be marked 12 points, while tract D, which is very close to the ditch, will be marked 28 points.

We will next mark these several tracts on the basis of fertility. Tract A being in the marsh and all of black alluvial land will be when drained extremely fertile, and, therefore, we will mark it 20 points. The same is true of tract B. Tract C is in the nature of a whitish clay, with fine sand mixed with it but is not fertile, so we will mark it 10 points. Tract D is more fertile than C, but probably less fertile than A and B, so we will mark it 15 points.

These several tracts all being situated in the same marsh will, when drainage is accomplished, receive the same amount of benefits as to the degree of healthfulness, so we will mark them each 10 points. Now, by adding the points of benefit assessed against the several tracts we have the relative benefit each will receive from the construction of the ditch. Performing this addition we find that

Tract A has 98 points.
Tract B has 80 points.
Tract C has 47 points.
Tract D has 73 points.

Then the assessment made against these tracts should be in the proportion of 73, 47, 80, and 98. Each of the other tracts in the drainage district should be treated in the same manner, and in many instances it will be found advisable to divide the sections into 40-acre tracts, and sometimes these 40-acre tracts may be subdivided in order to get the proper amount of the different classes of lands. When this classification is made the results should be entered in the commissioners' field book, as shown by the sample page submitted herewith. This book when completed shows the relative amount of benefits that each tract in the drainage district will receive as compared with all other tracts in the district, but does not show the sum in dollars and cents that it will be assessed for the construction of an improvement. This can be determined by the county auditor or the drainage commissioner in the manner hereinafter explained.

A report prepared in this manner will inspire confidence and carry weight with it. Any landowner may see what class his land is in and ascertain by an inspection of the report why it was placed in that class. This would be much more satisfactory than to have the land returned with an assessment of so many dollars marked against it without any indication of how such a sum was determined.

After having determined by the above method in what proportion the assessment should be made against the several tracts, it is next in order to determine how much of the total cost each tract should be assessed. Before doing this, however, it is necessary to determine the assessment against the public at large and against the railroads and the interurban lines, if there be any. The assessment against the farm lands attach to the reality itself and not to the owner and if not paid when due, the land can be sold to enforce the payment of the assessment, but not so with an assessment against the general public or the railroad. This is more in the nature of a personal obligation; it is a debt against a corporation and not a lien on any particular part of the roadbed or track and can be collected only as other debts are collected.

If the road-bed of any railroad or interurban line is improved by affording better drainage, the railroad will be benefited by the construction of the drain and should be assessed therefor, but an assessment should not be levied against a railroad in view of the fact that when farm lands are drained it will have an increased tonnage of freight to haul from the district or that towns and villages will spring up, and it will have an increased revenue from the passenger and express business. This is part of the benefit that accrues to the public at large as a result of drainage. A railroad may be viewed as integral part of this community and should not be subject to a special assessment any more than a merchant or manufacturer who will secure an increased sale for his wares because of the increase in the growth of the community. The assessment against railroads should, therefore, be confined to and based on the improvement or benefit to their material property.

Under the Indiana law, the ninth cause for remonstrance is that the proposed work will neither improve the public health nor benefit any public highway of the county, nor be a public utility. If this be true no public drain will be established, as it is to serve this public function that drainage districts are organized. The public, then, being benefited, should pay a portion of the cost of the work. The law does not specify as to what degree the public must be benefited in order to warrant the creation of a drainage district, but it has been repeatedly held by the courts that some degree of public benefit must be proved before the drain may be established. This leaves it, then, with the viewers to determine the amount of such benefit. It may be a mere nominal sum or it may be a large amount, owing to the character, location, and extent of the lands to be drained. If the area to be drained should be large, extremely swampy, and malarious, the high land adjacent thickly populated, and the roads crossing the swamp, connecting different parts of the locality, impassable at certain portions of the year, the resulting benefit to the community would be large and the assessment against the township or county should be in proportion to the benefit. A small drain in a well-improved agricultural country to serve a limited territory might be of little use to the general public and the assessment against the town or county for its construction should be correspondingly small. There is no rule governing this matter as each particular case must be viewed and treated separately in the light of the surrounding conditions. The assessment against the township or county because of the public utility and the assessment against the several railroads and interurban lines having been determined, this amount should be deducted from the entire cost of the improvement and the remainder of the cost distributed over the lands benefited.

Having determined the proportion of the total cost to be paid by the landowners, it can be distributed by an accountant in the following manner:

Assume an assessment of as many mills per acre against each tract of land as it has points of benefit and multiply this by the number of acres in the tract, for a basis assessment. Thus, in the illustration given above, A has 98 points, B 80 points, C 47 points, and D 73 points. Now assume an assessment of 98 mills per acre against A, 80 mills per acre against B, 47 mills per acre against C, and 73 mills per acre against D, and multiply these several amounts by the number of acres in the tract. We will then have; for A, a basis assessment of $15.68; $12.80 against B; $7.52 against C; $11.68 against D. Adding these, we have as the sum of the basic assessments, $47.68. This is not as high as the assessment will have to be made on these several tracts, but if we divide the entire cost of the work by this amount it will show how many times they will have to be repeated; hence, we divide the entire cost of the work by the sum of these basic assessments and the quotient will be a coefficient showing how many times these basic assessments will have to be repeated to produce the entire amount required.

If these were the only four tracts in the district and the total cost of the work was $3,432.96, then to ascertain what part of this cost should be assessed against each tract we would divide $3,432.96 by $47.68, the sum of the basic assessments, and it would give a quotient of 72, which is the coefficient showing how many times these basic assessments must be taken. By multiplying the basic assessment on each tract by this coefficient, we get the entire assessment on each tract. Thus the basic assessment on tract A, $15.68 multiplied by 72, gives $1,128.96, the entire assessment on tract A; tract B, $12.86 multiplied by 72, gives $921.60, the entire assessment on tract B; tract C, 7.52 multiplied by 72, gives $541.44, the entire assessment on tract C; and tract D, $11.68, multiplied by 72, gives $841.96, the entire assessment on tract D. Adding these several assessments we get $3,432.96, the cost of the work, to be paid by all of these tracts. In case it is ever required to raise an additional sum to meet some unforeseen expense, it can be apportioned in the same manner.

The method here suggested may not be perfect, but has the advantage of being based on some principle, and will surely give more uniform results than a mere guess. In the modern judging of stock, corn, or other products a score card is used indicating the points to be considered and giving the maximum value that should attach to each of these points. In a competitive contest of any kind much more satisfactory results can be ascertained when the marking is based on certain designated points of efficiency or scale.

Where several points are to be taken into consideration and determined by a matter of judgment, if one is considered too high another is just as likely to be marked too low, and on the whole the average is more likely to be correct than if the judgment is predicated on a single point. In your experience, you may find it advisable to give different values than those suggested in this paper to the several attributes to be taken into consideration, but I would earnestly recommend that this or some similar method of assessing benefits be adopted.

JUPITER CREEK DRAINAGE DISTRICT.

SPECIMEN PAGE.

FORM OF COMMISSIONERS' RECORD BOOK OF ASSESSMENTS.
JUPITER CREEK DRAINAGE DISTRICT.
SEPTEMBER 25, 1907.

Name of Owner.	Number of Acres.	Description.	Points of Benefit.	Basic Assessment.	Coeffi-cient.	Total Assessment.
A	160	NE. ¼ Sec. 8	98	$15 68	72	$1,128 96
B	160	SE. ¼ Sec. 15	80	12 80	72	921 60
C	160	SE. ¼ Sec. 22	47	7 52	72	541 44
D	160	SE. ¼ Sec. 33	73	11 68	72	840 96
	640			$47 68		$3,432 96

SPECIMEN PAGE.

FORM OF DRAINAGE COMMISSIONERS' FIELD BOOK OF CLASSIFICATION.
JUPITER CREEK DRAINAGE DISTRICT.
SEPTEMBER 25, 1907.

Name of Owner.	Number of Acres.	Description.	Points of Benefit.				
			Wetness 0—40	Proximity 0—30	Fertility 0—20	Health 0—10	Total 0—100
A	160	NE. ¼ Sec. 8	40	20	16	16	98
B	160	SE. ¼ Sec. 15	35	15	20	10	80
C	160	SE. ¼ Sec. 22	15	12	10	10	47
D	160	SE. ¼ Sec. 33	20	28	15	10	73

PUBLICATIONS

OF THE

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

BULLETINS.

1. Iron Ores of North Carolina, by Henry B. C. Nitze, 1893. 8°, 239 pp., 20 pl., and map. *Postage 10 cents.*

2. Building and Ornamental Stones in North Carolina, by T. L. Watson and F. B. Laney in collaboration with George P. Merrill, 1906. 8°, 283 pp., 32 pl., 2 figs. *Postage 25 cents. Cloth-bound copy 30 cents extra.*

3. Gold Deposits in North Carolina, by Henry B. C. Nitze and George B. Hanna, 1896. 8°, 196 pp., 14 pl., and map. *Out of print.*

4. Road Material and Road Construction in North Carolina, by J. A. Holmes and William Cain, 1893. 8°, 88 pp. *Out of print.*

5. The Forests, Forest Lands and Forest Products of Eastern North Carolina, by W. W. Ashe, 1894. 8°, 128 pp., 5 pl. *Postage 5 cents.*

6. The Timber Trees of North Carolina, by Gifford Pinchot and W. W. Ashe, 1897. 8°, 227 pp., 22 pl. *Postage 10 cents.*

7. Forest Fires: Their Destructive Work, Causes and Prevention, by W. W. Ashe, 1895. 8°, 66 pp., 1 pl. *Postage 5 cents.*

8. Water-powers in North Carolina, by George F. Swain, Joseph A. Holmes and E. W. Myers, 1899. 8°, 362 pp., 16 pl. *Postage 16 cents.*

9. Monazite and Monazite Deposits in North Carolina, by Henry B. C. Nitze, 1895. 8°, 47 pp., 5 pl. *Postage 4 cents.*

10. Gold Mining in North Carolina and other Appalachian States, by Henry B. C. Nitze and A. J. Wilkins, 1897. 8°, 164 pp., 10 pl. *Postage 10 cents.*

11. Corundum and the Basic Magnesian Rocks of Western North Carolina, by J. Volney Lewis, 1895. 8°, 107 pp., 6 pl. *Postage 4 cents.*

12. History of the Gems Found in North Carolina, by George Frederick Kunz, 1907. 8°, 60 pp., 15 pl. *Postage 8 cents. Cloth-bound copy 30 cents extra.*

13. Clay Deposits and Clay Industries in North Carolina, by Heinrich Ries, 1897. 8°, 157 pp., 12 pl. *Postage 10 cents.*

14. The Cultivation of the Diamond-back Terrapin, by R. E. Coker, 1906. 8°, 67 pp., 23 pl., 2 figs. *Postage 6 cents.*

15. Experiments in Oyster Culture in Pamlico Sound, North Carolina, by Robert E. Coker, 1907. 8°, 74 pp., 17 pl., 11 figs. *Postage 6 cents.*

16. Shade Trees for North Carolina, by W. W. Ashe, 1908. 8°, 74 pp., 10 pl., 16 figs. *Postage 6 cents.*

17. Terracing of Farm Lands, by W. W. Ashe, 1908. 8°, 38 pp., 6 pl., 2 figs. *Postage 4 cents.*

18. A List of Elevations in North Carolina, by Joseph Hyde Pratt. *In preparation.*

19. The Tin Deposits of the Carolinas, by Joseph Hyde Pratt and Douglass B. Sterrett, 1905. 8°, 64 pp., 8 figs. *Postage 4 cents.*

20. The Loblolly Pine in Eastern North Carolina, by W. W. Ashe. *In preparation.*

ECONOMIC PAPERS.

1. The Maple-Sugar Industry in Western North Carolina, by W. W. Ashe, 1897. 8°, 34 pp. *Postage 2 cents.*

2. Recent Road Legislation in North Carolina, by J. A. Holmes. *Out of print.*

3. Talc and Pyrophyllite Deposits in North Carolina, by Joseph Hyde Pratt, 1900. 8°, 29 pp., 2 maps. *Postage 2 cents.*

4. The Mining Industry in North Carolina During 1900, by Joseph Hyde Pratt, 1901. 8°, 36 pp., and map. *Postage 2 cents.*

5. Road Laws of North Carolina, by J. A. Holmes. *Out of print.*

6. The Mining Industry in North Carolina During 1901, by Joseph Hyde Pratt, 1902. 8°, 102 pp. *Postage 4 cents.*

7. Mining Industry in North Carolina During 1902, by Joseph Hyde Pratt, 1903. 8°, 27 pp. *Postage 2 cents.*

8. The Mining Industry in North Carolina During 1903, by Joseph Hyde Pratt, 1904. 8°, 74 pp. *Postage 4 cents.*

9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

10. Oyster Culture in North Carolina, by Robert E. Coker, 1905. 8°, 39 pp. *Postage 2 cents.*

11. The Mining Industry in North Carolina During 1905, by Joseph Hyde Pratt, 1906. 8°, 95 pp. *Postage 4 cents.*

12. Investigations Relative to the Shad Fisheries of North Carolina, by John N. Cobb, 1906. 8°, 74 pp., 8 maps. *Postage 6 cents.*

13. Report of Committee on Fisheries in North Carolina. Compiled by Joseph Hyde Pratt, 1906. 8°, 78 pp. *Postage 4 cents.*

14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt. *In press.*

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina. Compiled by Joseph Hyde Pratt, 1908. 8°, 45 pp., 1 pl. *Postage 4 cents.*

17. Report of Drainage Convention. Compiled by Joseph Hyde Pratt, 1908. 8°, 94 pp. *Postage 4 cents.*

VOLUMES.

Vol. 1. Corundum and the Basic Magnesian Rocks in Western North Carolina, by Joseph Hyde Pratt and J. Volney Lewis, 1905. 8°, 464 pp., 44 pl., 35 figs. *Postage 32 cents. Cloth-bound copy 30 cents extra.*

Vol. II. Fishes of North Carolina, by H. M. Smith, 1907. 8°, 453 pp., 21 pl., 188 figs. *Postage 30 cents.*

Vol. III. Miscellaneous Mineral Resources in North Carolina, by Joseph Hyde Pratt. *In preparation.*

Samples of any mineral found in the State may be sent to the office of the Geological and Economic Survey for identification, and the same will be classified free of charge. It must be understood, however, that NO ASSAYS, OR QUANTITATIVE DETERMINATIONS, WILL BE MADE. Samples should be in a lump form if possible, and marked plainly on outside of package with name of sender, post-office address, etc.; a *letter* should accompany sample and *stamp* should be enclosed for reply.

These publications are mailed to libraries and to individuals who may desire information on any of the special subjects named, free of charge, except that in each case applicants for the reports should forward the amount of *postage* needed, as indicated above, for mailing the bulletins desired, to the *State Geologist, Chapel Hill, N. C.*

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, State Geologist

ECONOMIC PAPER No. 18

PROCEEDINGS
OF
SECOND ANNUAL DRAINAGE CONVENTION
HELD AT
NEW BERN, NORTH CAROLINA

NOVEMBER 11 AND 12, 1909

COMPILED BY
JOSEPH HYDE PRATT

AND

NORTH CAROLINA DRAINAGE LAW

MAY 20, 1775

RALEIGH
E. M. Uzzell & Co., State Printers and Binders
1909

N 557
N 813a

GEOLOGICAL BOARD.

GOVERNOR W. W. KITCHIN, *ex officio Chairman*	Raleigh.
FRANK R. HEWITT	Asheville.
HUGH MACRAE	Wilmington.
C. S. VANN	Edenton.
R. D. CALDWELL	Lumberton.

JOSEPH HYDE PRATT, State Geologist	Chapel Hill

LETTER OF TRANSMITTAL.

CHAPEL HILL, N. C., December 1, 1909.

To His Excellency, HON. W. W. KITCHIN,

Governor of North Carolina.

Sir:—On November 11th and 12th there was held at New Bern, North Carolina, one of the most important conventions that has been held in the State during the past year. This was the Drainage Convention held under the auspices of the North Carolina Drainage Association. On account of the importance of this convention to the subject of drainage in North Carolina and the close co-operative work the North Carolina Geological and Economic Survey has carried on with he Drainage Association, I recommend that the proceedings of this convention be published as Economic Paper No. 18, of the publications of he North Carolina Geological and Economic Survey.

Yours respectfully,

JOSEPH HYDE PRATT,

State Geologist.

CONTENTS.

PAGE.

Introduction 7

Proceedings of the Convention 8

  Morning Session, November 11th 8

    Address of Welcome by C. J. McCarthy 8

    Appointment of Committees 10

    Practical Results of the Drainage of Swamp Lands, by J. O. Wright ... 10

      Discussion of Address 16

  Afternoon Session, November 11th 16

    Land Drainage from an Engineering Standpoint, by E. W. Myers .. 16

    Is the Drainage of North Carolina Swamp Lands Practicable? by Joseph Hyde Pratt ... 20

      Discussion 21

  Night Session, November 11th 22

  Morning Session, November 12th 23

    Report of Committee on Nominations 23

  Afternoon Session, November 12th 25

    Report of Committee on Resolutions 25

    Discussion of North Carolina Drainage Law 28

    Counties Represented at Convention 29

North Carolina Drainage Law 31

Instructions and Suggestions to Engineers and Viewers in Connection with the Establishment of Drainage Districts in North Carolina, by Joseph Hyde Pratt ... 47

PROCEEDINGS

OF THE

SECOND ANNUAL DRAINAGE CONVENTION,

HELD UNDER THE AUSPICES OF THE

NORTH CAROLINA DRAINAGE ASSOCIATION,

NEW BERN, N. C., NOVEMBER 11 AND 12, 1909.

COMPILED BY

JOSEPH HYDE PRATT, State Geologist.

INTRODUCTION.

The first Drainage Convention held in North Carolina was at New Bern, in September, 1908. This convention adopted resolutions endorsing a drainage bill which it believed would make possible the drainage of thousands of acres of swamp and overflowed lands in North Carolina, and also resolved itself into a permanent organization to be known as the North Carolina Drainage Association. The final result of this first convention and the organization of the Drainage Association was the passage of the North Carolina Drainage Act by the Legislature of 1909. That the passage of this act was a wise measure, and one that will be the means of bringing under cultivation thousands of acres of swamp lands in eastern North Carolina, and overflowed lands in the Piedmont and Mountain regions is evidenced by the fact that since its passage twelve drainage districts have been formed or are in the process of formation.

These drainage propositions, which undertake the drainage of thousands of acres of swamp land, are large undertakings, and can be accomplished only by the combined efforts of those owning the land. The success of the proposition depends upon the wise expenditure of thousands and sometimes hundreds of thousands of dollars, and, for that reason, the North Carolina Drainage Law contains provisions so that no drainage under this law can be undertaken until it has been definitely proved by surveys that the proposition is feasible, and that the cost of the drainage is not greater than the benefits that the land will derive from its drainage. As yet, this Drainage Law is not thoroughly understood, and many of our larger farmers have an idea that they could drain their own lands cheaper and perhaps better than by becoming part of a drainage district; while, on the other hand, the small farmer who owns but a few acres of land has an idea that he will be unjustly taxed if he enters a drainage district, and have to bear a large proportion of the cost of the drainage. Both of these classes of men have a misconceived idea of the Drainage Law, which very carefully safeguards the interests of the small farmer as well as the larger farmer. It is absolutely impossible for the farmer owning 10,000 to 20,000 acres of land to drain this as satisfactorily by himself as by the formation of a drainage district.

There is given at the end of the report of the proceedings a copy of the North Carolina Drainage Act.

To this Second North Carolina Drainage Convention which was held under the auspices of the North Carolina Drainage Association delegates were appointed from the following counties in eastern North Carolina: Currituck, Pasquotank, Perquimans, Chowan, Dare, Tyrrell, Washington, Bertie, Martin, Pitt, Beaufort, Hyde, Pamlico, Craven, Gates, Jones, Onslow, Carteret, Lenoir, Duplin, Pender, Hertford, Sampson, Bladen, Robeson, Columbus, Cumberland, Brunswick, New Hanover, Greene, Edgecombe, Wilson.

The mayors of all the towns in these counties were also appointed delegates, and the Governor appointed eighty-four delegates at large in the State.

PROCEEDINGS OF THE CONVENTION.

Morning Session, November 11.

The first meeting was called to order on Thursday morning, November 11th, at 10:30 o'clock, by John Wilkinson, president of the North Carolina Drainage Association, who called upon Rev. J. H. Brown, rector of Christ's Church, to offer prayer.

The chairman of the convention then called upon Hon. C. J. McCarthy, Mayor of New Bern, who welcomed the delegates to the city.

ADDRESS OF WELCOME BY C. J. McCARTHY.

Mr. President, Delegates of the North Carolina Drainage Association.

Gentlemen:—I come to you this morning in behalf of the city of New Bern to welcome you in our midst. Yes, gentlemen, I come in behalf of the "Athens of the Old North State" to extend to the North Carolina Drainage Association a most cordial welcome.

Esteemed guests, my welcome goes still deeper, for I introduce you into the hearts and homes of my people, of whom, if I should try to give the praise that is due them, words and eloquence would fail me. Our people have only one desire while you are in their midst, and that is to make your stay one of continuous enjoyment.

And while this is a duty of joy and pleasure to us, it will be your opportunity to solve a problem which, if accomplished, will be one of the grandest achievements that ever happened for this section of the State.

The drainage of the lowlands in our section not only means gold and silver to us, but it means more—it means draining away the stagnant waters whose unwholesome vapors are such a menace to this section. We are not unmindful, gentlemen, that the undertaking of this great and noble enterprise will require earnest thought and the expenditure of some money, but with the coöperation that you have here to-day, nothing but success can follow. Let me conclude by repeating a verse that I heard a small child recite a few days ago, and which reminds me of this intended undertaking:

"One step, then another, and the longest walk is ended;
One stitch, then another, and the largest rent is mended;
One brick, then another, and the highest wall is made;
One flake upon another, and the deepest snow is laid.

"Then do not frown or murmur at the work you have to do,
Or say that such a mighty task you never can get through.
But try in earnest day by day another point to gain;
And soon the lowlands which you feared will prove to be all drained."

The following committees were then appointed:

Committee on Resolutions: Ernest Green, of New Bern, chairman John H. Small, Washington; W. S. Chadwick, Beaufort; Joseph A Brown, Chadbourn; S. W. Everett, Oriental; G. B. McLeod, Lumberton, and Walter Jones, Swanquarter.

Committee on Nominations and Place of Next Meeting: B. F. Keith of Wilmington, chairman; C. R. Thomas, New Bern; T. H. B. Gibbs Fairfield; H. K. Wolcott, Norfolk; C. R. Humphries, Wilmington; A B. Lukens, Moyock, and John S. Morton, North Harlowe.

The next speaker was Mr. J. O. Wright, Supervising Drainage Engineer of the United States Department of Agriculture, who spoke on th subject of the practical value of drainage. Mr. Wright's talk was illustrated with charts and diagrams which added very much to the interes and value of his paper.

PRACTICAL RESULTS OF THE DRAINAGE OF SWAMP LANDS.

By J. O. WRIGHT.

There is published in the November number of "World's Work" an articl by James J. Hill, who has probably done more than any other man to develo the farm lands of the great Northwest. In this article Mr. Hill shows co clusively that agriculture has not kept pace with the growth of the country i other respects. The increase in population, manufactures, and commerce hav far outstripped the increase in agricultural products. Since 1880 our popul tion has increased 74 per cent and the growth of wheat only 41 per cen During this period the wheat-producing area has moved westward, thus i creasing the acreage, while the average yield per acre has steadily decreased

The same thing is practically true of corn. In 1880 the corn crop wa 1¾ billion bushels, while in 1908 it was 2⅝ billion bushels, being an increa of about 54 per cent. The extension of the corn belt has reached its limi There are no more corn-producing States to be settled and brought into cultiv tion. The peculiar soil and climatic conditions necessary to grow good co are confined to a much smaller area than the wheat-producing section. The is no foreign country from which corn can be imported. Its growth is pra tically restricted to the Mississippi Valley and the Atlantic Coast State Because of shiftless and profligate methods of farming, the yield of corn p acre is gradually decreasing in a number of the States. Twenty years a the people of Illinois boasted of the inexhaustible fertility of their bla prairie soil, and continued to grow corn on the same land year after ye until they became alarmed at the constantly decreasing yield. Experimen show that twelve years' cropping, where corn followed corn, reduced the yie from 70 to 35 bushels per acre. This means that the middle West has reach its zenith as a corn-producing section. If the yield per acre is to be mai tained, some form of crop rotation must be practiced. This will reduce t acreage in this section.

My object in calling attention to this condition is to impress upon you the fact that good corn land is the very best asset that a State or an individual can possess. It is growing scarcer and scarcer each year and will always command a very high price. Good corn land to-day, whether in Iowa, Illinois, or North Carolina, is worth upwards of $100 per acre. In the article above cited, Mr. Hill presents a map of the United States showing graphically the area of the several States and the amount of improved and unimproved farm land. With the exception of Florida and the arid States, North Carolina has the smallest per cent of improved land of any State in the Union. With her 31,000,000 acres extending from Currituck to Cherokee, there were in 1900 but 8,000,000 acres of improved farms.

Of this vast area of unimproved land, I wish to call your attention to the 3,000,000 acres of swamp and overflowed land scattered along the Atlantic coast from Virginia to South Carolina. The fertility of this vast area is unsurpassed. Enough has been reclaimed and put in cultivation to demonstrate that it is pre-eminently a corn soil. The greatest yield of corn ever produced on an acre of land was grown in the Carolinas. God has provided the soil, the rain, and the sunshine, and if man were to do his part there could be established here a corn belt that would surpass the richest parts of Indiana or Illinois.

North Carolina, at the present time, produces 2.7 per cent of the entire corn crop of the United States. If these swamp lands were thoroughly drained and properly cultivated, they alone could be made to produce a crop of corn equal to 10 per cent of all the corn raised in the United States this year. It is my purpose to-day to discuss with you the reclamation of these lands, and let you decide whether it will pay to drain them or not. From my personal knowledge of these swamp lands, I think they may be properly divided into three great classes:

First, the great area of gum and cypress swamp. This land is distributed over a large portion of the eastern part of the State, either in long, narrow belts, ranging from one-quarter mile to two miles in width, or in extensive areas several miles in diameter. It was originally heavily timbered in gum, cypress, maple, poplar, ash, and other soft woods. Most of this timber has been removed or is under contract to be removed in the near future. This type of land does not reforest readily and is especially suited for agriculture. When the timber is removed it has a speculative value of from $3 to $8 per acre, according to location, but yields no revenue whatever to the owner.

A second type is the open marsh, commonly called bay or pocoson. It is found in large areas in Washington, Tyrrell, Dare, Pamlico, Craven, Jones, Onslow, and Pender counties. It is a muck soil, varying in depth from 1 to 10 feet. There is but little timber on these lands, and that is of poor quality. In its present condition this land is absolutely worthless. It is even too wet and boggy for grazing. What it needs is deep drainage, and, as it settles, to be pastured with cattle, sheep, and goats. It is not a well-balanced soil, but when thoroughly drained and limed it produces good crops.

The third type and by far the most important one is the extensive area of poorly drained cleared land. The farms are cultivated in a shiftless way and yield a scant income when the season is favorable. Such farms are common in all parts of eastern North Carolina. Some of them have been cleared and in cultivation for 100 years, and are not yet brought to a paying basis. If the owners grow a good crop one year, they are likely to lose the next three from lack of adequate drainage. This takes away all the profit in farming such lands.

Hyde County furnishes a marked example of this type. For the past three years the profits have been literally drowned out, while for this year there has been just the right amount of rain at the proper time and the crops are excellent. If the people of Hyde could have a good crop, such as the present one, each year, they would soon grow to be the richest people in the State. It is the certainty of a good crop each year that brings prosperity.

From Moyock to Edenton there is scarcely a farmer that has made half a crop for the past four years. They have ploughed and planted, but reaped not. The seed potatoes rotted in the ground and the corn and cotton stood in the water until their growth was checked or they turned yellow and died. Such farms are not a profitable investment, and a community of such farms is not a prosperous community. Without drainage these lands will remain cheap, and the living that can be wrested from them by hard work will be a cheap living. With proper drainage, good seed, and better methods of cultivation, this type of land can be made a most profitable investment.

To get the profit in drainage before you in the most striking manner, I have prepared some tables dealing with the three types of land in eastern North Carolina requiring drainage. The figures used are the average of a number of examples taken from actual practice. Example No. 1 deals with 40 acres of gum swamp from which the merchantable timber has been removed.

For the benefit of those who are not acquainted with the method of clearing and cultivating land in eastern North Carolina, I will explain what is meant by "stuck corn." When a piece of swamp is drained and the merchantable timber removed, the remaining growth is cut close to the ground and caused to fall flat and trimmed so as to lie close and make a uniform covering on the land. This work is usually done during the fall or winter. In the following spring when it is well dried out it is fired at various points and completely burned over. This burning not only destroys all the leaves, brush and most of the trunks, but also every sprig of green vegetation and all the weed and grass seeds on the land. Without any further preparation the land is then staked off in rows the proper distance apart and corn is planted by making holes with a stick about one foot apart and putting in a grain of corn and covering it with the foot. The corn requires no cultivation and often makes 50 bushels per acre. The success of this method depends largely upon getting a good burn on the lands. Great care should be taken to keep the fire out of the woods until such time as it is desired to make the "burn."

EXAMPLE No. 1.

PROFIT AT THE END OF FIVE YEARS IN RECLAIMING 40 ACRES OF GUM SWAMP UNDER THE STATE DRAINAGE LAW AND CULTIVATING SAME IN CORN.

FIRST YEAR.		*Cost.*	*Income.*
40 acres swamp at $5 per acre	$ 200.00		
First payment of interest on drainage bonds	9.60		
Amount invested at end of year		$ 209.60	
SECOND YEAR.			
During this year the outlet canal should be completed.			
Cutting down growth on 40 acres at $7 per acre	$ 280.00		
Digging 640 rods open ditch at 30 cents	192.00		
Second payment of interest	9.60		
		481.60	
Amount invested at end of second year		$ 691.20	
THIRD YEAR.			
Crop of stuck corn is to be given this year; yield to be expected 50 bushels per acre—2,000 bushels.			
8 bushels seed corn at $1 per bushel	$ 8.00		
Planting 40 acres at $1.25 per acre	50.00		
Chopping out once, 20 days at $1	20.00		
Gathering 2,000 bushels at 6 cents per bushel	120.00		
First installment drainage tax	16.00		
Third installment interest on bonds	9.60		
		223.60	
Amount invested at end of third year		$ 914.80	
2,000 bushels corn at 70 cents per bushel			$ 1,400.00
FOURTH YEAR.			
Crop of corn to be cultivated; yield to be expected, 60 bushels per acre—2,400 bushels.			
Cutting and burning logs, $6 per acre	$ 240.00		
Cleaning out field ditches, 10 cents per rod	64.00		
Planting and cultivating 40 acres at $8 per acre	320.00		
Gathering 2,400 bushels at 4 cents per bushel	96.00		
Fourth installment drainage tax	16.00		
Fourth payment of interest on bonds	8.64		
		744.64	
Amount invested at end of fourth year		$ 1,659.44	
2,400 bushels corn at 70 cents per bushel			1,680.00
FIFTH YEAR.			
Crop of corn to be grown and, when laid by, sown in cowpeas; yield to be expected, 60 bushels of corn per acre—2,400 bushels corn and 30 tons pea hay.			
Removing and burning small stumps	$ 160.00		
Planting and cultivating corn	320.00		
Gathering 2,400 bushels at 4 cents	96.00		
50 bushels cowpeas at $1.75 per bushel	87.50		
Harvesting 40 acres cowpeas at $4 per acre	160.00		
Fifth installment drainage tax	16.00		
Fifth payment of interest on bonds	7.68		
		847.18	
Amount invested at end of fifth year		$ 2,506.62	
2,400 bushels corn at 70 cents			1,680.00
30 tons cowpea hay at $15 per ton			450.00
Total income at end of fifth year			$ 5,610.00
Value of land at end of fifth year			2,400.00
Total income from transaction			$ 7,610.00
Less amount expended			2,506.62
Net profit for five years			$ 5,103.38

EXAMPLE No. 2.

PROFIT AT THE END OF FIVE YEARS IN RECLAIMING 40 ACRES OF OPEN MARSH OR POCOSON UNDER THE STATE DRAINAGE LAW AND CULTIVATING SAME IN CORN AND COWPEAS.

		Cost.	*Income.*
FIRST YEAR.			
40 acres of open marsh at $2 per acre	$ 80.00		
First payment of interest on drainage bonds	6.00		
Amount invested end of first year		$ 86.00	
SECOND YEAR.			
Outlet should be completed so that field ditches may be dug.			
800 rods of field ditch with earth scraped back from edge, at 37 cents per rod	$ 296.00		
Liming 40 acres at $5 per acre	200.00		
Second payment of interest on bonds	6.00		
		502.00	
Amount invested end of second year		$ 588.00	
THIRD YEAR.			
Crop of corn should be grown; yield to be expected, 40 bushels per acre—1,600 bushels.			
Planting and cultivating 40 acres corn at $7 per acre	$ 280.00		
Gathering 1,600 bushels at 4 cents per bushel	64.00		
First installment of drainage tax	10.00		
Third payment of interest on bonds	6.00		
		360.00	
Amount invested at end of third year		$ 948.00	
1,600 bushels corn at 70 cents per bushel			$ 1,120.00
FOURTH YEAR.			
Crop corn and cowpeas.			
Growing 40 acres corn at $6 per acre	$ 240.00		
50 bushels cowpeas at $1.60 per bushel	80.00		
Gathering corn, 1,600 bushels, at 4 cents	84.00		
Harvesting 40 acres pea hay at $4 per acre	160.00		
Liming 40 acres at $3 per acre	120.00		
Second installment of drainage tax	10.00		
Fourth payment of interest on bonds	5.40		
		679.40	
Amount invested end of fourth year		$ 1,627.40	
1,600 bushels corn at 70 cents			1,120.00
40 tons pea hay at $15 per ton			600.00
FIFTH YEAR.			
Crop of corn and cowpeas.			
Growing 40 acres corn at $6 per acre	$ 240.00		
50 bushels cowpeas at $1.60 per bushel	80.00		
Gathering corn, 2,000 bushels, at 4 cents	80.00		
Harvesting 40 acres pea hay at $4 per acre	160.00		
Third installment drainage tax	10.00		
Fifth payment of interest on bonds	4.50		
		574.80	
Amount invested end of fifth year		$ 2,202.20	
2,000 bushels corn at 70 cents			1,400.00
50 tons pea hay at $15 per ton			750.00
Total income			$ 4,990.00
Less total investment			2,202.20
			$ 2,787.80
40 acres of land at $50 per acre			2,000.00
Net profit for five years			$ 4,787.80

EXAMPLE No. 3.

Profit at the End of Five Years from Improving a Poorly Drained 40-acre Farm and Growing Cotton, Corn, Cowpeas and Irish Potatoes—General Drainage Tax $3.20 per Acre.

First Year.		*Cost.*	*Income.*
40 acres cleared land at $25 per acre	$ 1,000.00		
First payment of interest on drainage bonds	7.68		
Amount invested end of first year		$ 1,007.68	
Second Year.			
Outlet canal completed so crop can be grown.			
800 rods field ditch, 25 cents per rod	$ 200.00		
Scraping back spoil bank	40.00		
Growing and marketing 40 acres cotton at $15	600.00		
Second payment of interest on drainage bonds	7.68		
		847.68	
Amount invested end of second year		$ 1,855.36	
Returns—30 bales cotton at 10 cents per pound			$ 1,500.00
Third Year.			
Growing and harvesting 40 acres corn at $7.60	$ 304.00		
Commercial fertilizer at $4 per acre	160.00		
50 bushels peas or soy beans	75.00		
First installment drainage tax	12.80		
Third payment of interest on bonds	7.68		
		559.48	
Amount invested end of third year		$ 2,414.84	
Returns—1,600 bushels corn at 70 cents			1,120.00
50 tons pea hay at $15			750.00
Fourth Year.			
Crop Irish potatoes followed by peas and millet.			
Growing and marketing 40 acres potatoes at $60	$ 2,400.00		
Peas and millet seed	80.00		
Harvesting hay crop, $4 per acre	160.00		
Cleaning out field drains	80.00		
Second installment drainage tax	12.00		
Fourth payment of interest on bonds	6.90		
		2,738.90	
Amount invested end of fourth year		$ 5,153.74	
Returns—2,400 barrels potatoes at $3			7,200.00
80 tons hay at $20			1,600.00
Fifth Year.			
Growing crop cotton at $18 per acre	$ 720.00		
Third installment drainage bonds	12.00		
Fifth payment of interest on bonds	6.12		
		738.12	
Amount invested end of fifth year		$ 5,891.86	
Returns—40 bales cotton at $50			2,000.00
Summary.			
Total increase for five years			$ 14,170.00
Value of land at end of fifth year			2,400.00
Total income for five years			$ 16,570.00
Less total expenses for five years			5,891.86
Net profit for five years			$ 10,678.14

Discussion of Address.—At the close of Mr. Wright's address Mr. Wilkinson paid a very high tribute to the work that Mr. Wright had done in eastern North Carolina, stating that the interest in drainage work in this State, and the work that had thus far been accomplished was largely due to the efforts of Mr. Wright.

This address of Mr. Wright's started a discussion which was entered into with a great deal of enthusiasm by many of the delegates, who took up the questions as to the practicability of the drainage of swamp lands in their sections, and also a discussion of the figures which Mr. Wright used in illustrating his arguments. The consensus of opinion of the delegates was that Mr. Wright's figures were, as a whole, correct, and represented pretty accurately what returns could be obtained by the drainage and cultivation of the swamp lands of North Carolina.

At the conclusion of this discussion the chairman called on Hon. John H. Small, of Washington, N. C., who spoke on "The Significance of the Drainage Movement," and perhaps the keynote of his address was the spirit of unity and co-operation which this great work demands if it is to meet the success that it deserves. He regarded the drainage of our swamp and overflowed lands as one of the more important questions before the public to-day.

The next speaker at the morning session was Hon. W. A. Graham, Commissioner of Agriculture, who spoke briefly on "The Value of Drainage to the Farmers of North Carolina." He expressed the interest of his Department in the work of the convention, and assured the delegates that the Department of Agriculture would assist in every way it could in advancing the cause of drainage in this State.

The morning session adjourned at 1 P. M.

AFTERNOON SESSION, NOVEMBER 11.

The session was called to order by the chairman, and the first speaker was Mr. E. W. Myers, a drainage engineer of Greensboro, N. C., who spoke on the subject, "Land Drainage from an Engineering Standpoint."

LAND DRAINAGE FROM AN ENGINEERING STANDPOINT.

BY E. W. MYERS.

If there are any here unconvinced of the material benefits to be derived from the proper drainage of the swamp and wet lands of North Carolina, I am sure that the arguments and eloquence of those who have spoken to you have brought the waverers over to the true faith.

Many of you have, of course, held the faith for a long time, and a number are showing this faith from their works. Your faith, in drainage at least, must show itself in works if it is to have any effect on your salvation.

Since, then, we are all of one mind about drainage, I am not going to talk to you about the increased crops you can produce, nor of the better roads you will have to travel over, nor of the increased freedom from malarial and other diseases which you will experience when the wet lands in your vicinity are properly drained. Instead, I wish to speak to you for a few minutes of the men on whom you will have to rely to accomplish these ends for you, and of the means whereby these very desirable things are to be brought about.

There are several directions from which the subject of land drainage may be approached, but in essence the matter is one primarily for the agriculturist and the engineer: the one interested in what may be done with the land after it has been drained; the other, first, in what will be required to drain the land, and in the methods and costs of the necessary works.

A talk, therefore, on the subject of land drainage from an engineering standpoint might cover the whole art and science of drainage. The best way to learn about land drainage from all points of view is to do it. That, then, is my advice to you—Go do it; and you will learn much more than any number of speeches or books can teach you. But as much of the necessary work must be done by proxy, I have thought that it might be of interest to consider this feature, which perhaps might better be called the relation of the engineer to a drainage project.

The drainage law under which we are working prescribes that when a drainage project is begun, and after certain preliminaries laid down in the law are complied with, that a competent and disinterested civil engineer shall be appointed, whom, then, with the two viewers appointed at the same time, becomes an investigating committee, searching out all the facts of the case, procuring all necessary information as to the feasibility of the drainage scheme, and reporting all this to the Clerk of the Superior Court of the county according to law.

These positions are of great responsibility, and it seems to me that certain qualifications are necessary in those holding them, the first and most important of which is that they be men of known integrity and firmness of purpose, not to be biased in judgment by any means whatsoever.

The second requisite is that these men should have practical knowledge, and that they should be possessed of good sound common sense—the kind that we usually call "hoss sense"—for the fate of the entire matter is with them at this stage, and hangs on the report which they shall make. Just how this is so is set out in the drainage law, with which you are all familiar, and which, therefore, I shall not take up your time by repeating.

And, thirdly, these men should know land, and be able to judge of the improvement in quality which would be caused by the proposed drainage, and then be able to fix this knowledge into definite words and figures for the guidance of the court.

These things apply to engineers and viewers alike; but the engineer must have other qualifications also.

A man who can use the ordinary surveying instruments and survey a farm or lay out town lots, or run a grade with a level, is not necessarily a civil engineer, though every civil engineer must be able to use these instruments and do these things if necessary; and while in some stages of the project it seems that knowledge of surveying is all that is required, it is not so at any time. It is, of course, important that the lines should be run accurately, but it is of even greater importance that they should be run in the right places to furnish the information desired, and that the information obtained from the surveys and investigations should be correctly interpreted and used; and this very thing involves the distinction between the civil engineer and the surveyor.

There is no good modern definition of what a civil engineer is or does, and those in need of such definition usually fall back on that given in the charter of the Institution of Civil Engineers of Great Britain, the great national engineering society, founded in 1828, which reads:

"The profession of a civil engineer, being the art of directing the Great Sources of Power in Nature for the use and convenience of man, as the means of production and of traffic in States both for internal and for external trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks, for internal intercourse and exchange; and in the construction of ports, harbors, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and adaptation of machinery, and in the drainage of cities and towns."

Primarily, then, the civil engineer must be a man skilled in the direction of the great forces of nature for the use and convenience of man.

Another and more modern definition of the engineer which is equally true with the one just given is that he must be "a man who can make one dollar do well what the ordinary man could do indifferently with two."

We have, then, for the qualifications of the engineer, integrity of character, sound common sense, knowledge of land as affected by drainage, theoretical and practical knowledge of the economic design and construction of drainage works, and, finally, the executive ability to insure that the works as planned are constructed with all reasonable economy.

These, to my mind, are the essential qualifications that the engineers who take charge of your drainage projects must have. The engineer who has them will save his employers much more than the amount of his fee in the lessened cost of the construction of the work, while the one who does not have them would be expensive if he gave his services for nothing and paid a bonus for the work.

Men who possess these qualifications are, as a rule, successful men, and the time of such men is valuable and commands a high price.

To make an examination of the land in any proposed drainage district and determine the most economic method of draining it, to locate the canals and ditches properly and compute the proper size of each to carry away the water which may reasonably be expected to reach them, to determine the questions of benefits and damages, and to make a just and equitable classification of the lands to obtain money for the construction of the works are tasks which require much time and patient and exhaustive research, and good and competent men, capable of doing these things, cannot be obtained without fair compensation.

The preparation of plans adequate for the needs of the district and the just apportionment of the costs on the lands benefited are matters that should be entrusted only to experienced men, as upon the correctness and efficiency of these works largely depends the ultimate cost and success of the work done.

After the work has been planned, its execution must be properly carried out, and therefore the construction must be supervised by a thoroughly competent man; and this man should be the engineer who prepared the plans and drew up the specifications under which the work is to be done, for a division of responsibility is thus avoided. Common experience in matters of this kind bears out the statement that better results are obtained in this way than are possible in any other.

Now, finally, while in his own estimation every man is more or less of an engineer, with his own opinion as to the best way of performing some proposed work, when your engineer has been selected he has been chosen for his expert knowledge of these very things, and the results you all desire will probably be reached with less cost and with greater satisfaction to all concerned if the engineer be given a free hand in the conduct of the work, so far as this is possible under the law.

There is nothing new in this attitude toward skill. When you are ailing you call in your doctor and follow his instructions, and take his medicines with the confidence that so doing will result in your recovery; and you do this though you may neither understand the reason for the one nor like the taste of the other; you neither advise as to the treatment to be followed nor as to the general conduct of the case, but you hold him responsible for the results. In the same way hold the engineer responsible for results, but let these results be produced in his own way. If your engineer has been wisely selected you may rest assured that a satisfactory drainage project will crown your efforts.

The next speaker was Mr. H. K. Wolcott, of the Norfolk and Southern Railway, who spoke very enthusiastically on the future of North Carolina, his subject being, "The Railroad's Interest in Drainage." He showed that the railroads are not independent of the public, nor the public independent of the railroads, but that both were dependent on each other; and he assured the delegates that as the farmers increased the output of their farms, the railroad would keep in close touch with them and meet their demands. He said their interests were mutual, and that he felt that there would be a close harmony between them which would promote the welfare of each. He stated that he thought in eastern North Carolina there was the greatest opportunity for the farmer of all places in the country, and that the most important step necessary to bring about the increased crops of the farms was drainage. Every swamp land that was drained meant an increased territory that would produce freight to be handled by the railroad, both to and from the farm. Thus any development in the utilization of these swamp lands meant increased traffic to the railroad, and it was, therefore, to the interest of the railroads to do all in their power in the carrying out of these drainage projects.

At the close of Mr. Wolcott's address the chairman called upon Mr. Joseph Hyde Pratt, State Geologist, to lead the discussion—

IS THE DRAINAGE OF NORTH CAROLINA SWAMP LANDS PRACTICABLE?

By Joseph Hyde Pratt.

In opening the discussion, Mr. Pratt called attention to what had been accomplished during the past four years, since the reorganization of the North Carolina Geological Survey by the Legislature of 1905, at which time the Geological Board authorized the State Geologist to begin investigations regarding the value of the swamp lands for agriculture, and the feasibility of draining same. He said:

As the appropriation available for this work was limited, the work had to be carried on slowly, but through a very generous co-operation of the Division of Drainage Investigations of the United States Department of Agriculture the work has been continued and its final results you all know.

The first investigations of the Survey determined:

1. The character of the swamp—whether the soil was suitable for agricultural purposes.

2. Whether the swamp and overflowed lands where suitable for agricultural purposes could be profitably drained.

3. Whether the peat swamps contain a sufficient quantity of this material and of such quality that it could be marketed.

In making these examinations, and in interviews with the people interested it was found that three obstacles had formerly been in the way of the drainage of these swamp lands: (1) The cost of clearing the land; (2) the excessive cost of digging adequate canals and ditches to take care of the water; (3) lack of adequate laws that would permit the carrying out of the drainage propositions.

Now, however, all these obstacles have been removed, and wherever the land has a sufficient agricultural value to warrant drainage, the drainage proposition can be carried out.

The drainage of these vast swamp areas of eastern North Carolina means not only additional wealth to the State in the form of agricultural lands, but it will mean improved roads through large areas that are now almost impassable and inaccessible. The improved roads will mean better school facilities for the children.

Of the three million acres of swamp land sufficient work has been done to warrant the statement that at least one million acres are of sufficient agricultural value to warrant their being drained.

Although the North Carolina Drainage Act has only been in operation a little over eight months, there are already twelve drainage districts formed or in the process of formation, which include 300,000 acres. These districts are as follows:

Moyock Drainage District, Currituck County.
Bear Swamp Drainage District, Chowan County.
Lake Mattamuskeet Drainage District, Hyde County.

Creswell Drainage District, Washington County.
Rich Square Drainage District, Northampton County.
Dover Drainage District, Craven County.
Pungo Drainage District, Beaufort County.
Lyon Swamp Drainage District, Pender and Bladen counties.
Wilkinson Drainage District, Beaufort County.
White Oak Swamp Drainage District, Bladen County.
Chadbourn Drainage District, Columbus County.
Toisnot Creek Drainage District, Wilson County.
Angola Bay Drainage District, Pender County.

Discussion.—There were representatives from nearly all these districts present at the convention, and Mr. Pratt called upon one or more from each district to state what they were doing, and what had been accomplished in their districts. The following delegates responded: Joseph A. Brown, Chadbourn; Lawrence Brett, Wilson; A. B. Lukens, Moyock; C. R. Vandecarr, Moyock; John A. Wilkinson, Belhaven; T. H. B. Gibbs, Fairfield; Patrick Matthew, Edenton; J. J. Wolfenden, New Bern; B. F. Keith, Wilmington; C. R. Humphries, Wilmington, and P. H. Johnson, Pantego, N. C.

The talks of these gentlemen brought out some very interesting information regarding the work that was being done in these different drainage districts, and illustrated very emphatically the interest that the people have in the drainage of these swamp lands. Already in some of the districts owners of the lands are making arrangements to begin planting, although the drainage work has only been partially completed. There were maps of nearly all these drainage districts on exhibition, and these added a great deal of interest to the talks of the delegates, inasmuch as they showed exactly the location of the districts, the location of the canals, and the mileage of canals necessary to drain certain areas.

Just before the close of the afternoon session the chairman called upon Mr. E. T. Lamb, general manager, Norfolk and Southern Railway, Norfolk, Va. Mr. Lamb in his response showed how vitally interested the Norfolk and Southern Railway was in the drainage of the swamp lands of eastern North Carolina, and stated that he hoped and expected to see the most cordial relations exist between the Norfolk and Southern Railway and the people of eastern North Carolina, as they were very dependent upon each other for maintenance. He stated that the railroad was ready at all times to assist in the development of different sections of eastern North Carolina, and would do whatever was consistent in assisting those who are working out the industrial problems of the State.

At 4:15 the convention adjourned until 8 P. M.

NIGHT SESSION, NOVEMBER 11.

The night session consisted of an illustrated lecture by Mr. Bristow Adams, of the United States Forest Service, on "Conservation." This lecture was largely attended and very instructive.

Mr. M. O. Eldridge, of the Office of Public Roads of the United States Department of Agriculture, had expected to give an illustrated lecture on the "Relation of Drainage to Public Roads," but unfortunately the express company failed to deliver the lantern slides.

SECOND DAY.

Morning Session, November 12.

The morning session of the convention was held on board the revenue cutter "Pamlico," which had been tendered the delegates by the United States Revenue Service for a cruise down the river.

The boat left the pier at 10:10, returning at 12:30.

After the boat had turned around and started on its return trip to New Bern, the chairman called the delegates to order and a short business session was held.

REPORT OF COMMITTEE ON NOMINATIONS.

The Committee on Nomination of Officers and Place of Next Meeting, Mr. B. F. Keith, chairman, reported as follows:

Place for next meeting—Wilmington, N. C.

President—J. A. Brown, Chadbourn, N. C.

Secretary and Treasurer—Joseph Hyde Pratt, State Geologist, Chapel Hill, N. C.

VICE-PRESIDENTS:

Bladen County—A. A. Clark, Rosindale, N. C.
Beaufort County—John Wilkinson, Belhaven, N. C.
Brunswick County—Jackson Johnson, Town Creek, N. C.
Camden County—W. G. Ferebee, Gregory, N. C.
Carteret County—W. S. Chadwick, Beaufort, N. C.
Columbus County—J. P. Council, Wananish, N. C.
Craven County—C. R. Thomas, New Bern, N. C.
Currituck County—A. B. Lukens, Moyock, N. C.
Greene County—D. M. Patrick, Snow Hill, N. C.
Guilford County—E. W. Myers, Greensboro, N. C.
Harnett County—H. L. Godwin, Dunn, N. C.
Hyde County—T. H. B. Gibbs, Fairfield, N. C.
Jones County—J. H. Bell, Pollocksville, N. C.
New Hanover County—B. F. Keith, Wilmington, N. C.
Onslow County—E. M. Koonce, Jacksonville, N. C.
Pamlico County—J. F. Cowell, Bayboro, N. C.
Pasquotank County—Dr. L. S. Blades, Elizabeth City, N. C.
Hertford County—R. C. Bridger, Winton, N. C.
Chowan County—S. C. Privott, Edenton, N. C.
Gates County—A. P. Godwin, Gatesville, N. C.
Pender County—A. B. Croom, Jr., Burgaw, N. C.

Bertie County—Samuel Freeman, Windsor, N. C.
Robeson County—George L. McLeod, Lumberton, N. C.
Duplin County—Z. J. Carter, Wallace, N. C.
Sampson County—John J. Fowler, Clinton, N. C.
Martin County—Harry Stubbs, Williamston, N. C.
Cumberland County—H. B. Downing, Cedar Creek, N. C.
Lincoln County—R. M. Roseman, Lincolnton, N. C.
Pitt County—H. W. Whedbee, Greenville, N. C.
Tyrrell County—John Pinner, East Lake, N. C.
Northampton County—Garland E. Midgett, Jackson, N. C.
Washington County—A. G. Walker, Washington, N. C.
Wilson County—Ed. Woodard, Wilson, N. C.
Edgecombe County—H. A. Gilliam, Tarboro, N. C.
Halifax County—Paul Kitchin, Scotland Neck, N. C.
Perquimans County—R. A. Brinn, Hertford, N. C.
Warren County—Huskell Polk, Warrenton, N. C.

Upon motion made and seconded this report was unanimously adopted.

Mr. Brown was officially notified of his election to the presidency of the Association and in response said that he appreciated the honor the convention had bestowed upon him, and promised his earnest efforts to accomplish everything he could for drainage in North Carolina. He stated that he believed the ultimate result of this drainage work would be increased productiveness of the farms, and therefore increased income to the producers, and that by making our low swamp lands more productive and more attractive we would cause our young men to become more attached to our farms and more willing to remain on the farms. Each year will see more and more land brought under cultivation, and as we put farming more and more on a business basis, we will very soon see our young men going into farming as a profession, and our farm lands will be settled by North Carolinians instead of immigrants from other countries.

Mr. W. C. Riddick, Professor of Civil Engineering of the Agricultural and Mechanical College, was then called upon, and he made a very pleasing address, showing the relation of the college to the agricultura and engineering interests of the State. He stated that he represented President D. H. Hill, who was unable to be present, and he promised the support of the Agricultural and Mechanical College to any who would ask them for assistance or advice in this work. He stated that th college was training young men for this work, teaching them the principles of drainage engineering. He also stated that since the passag of the North Carolina Drainage Law, which now makes it possible t form drainage districts, that the college was preparing courses that would train the young men especially for this particular work in North Carolina.

By unanimous vote of the delegates the officers and crew of the revenue cutter "Pamlico" were thanked for their courtesies extended to the delegates on board, and all expressed themselves greatly pleased with the trip down the river.

A resolution was adopted making the annual dues of the North Carolina Drainage Association $1.

Afternoon Session, November 12.

The afternoon session was called to order at 2 P. M. with the newly elected president, Joseph A. Brown, in the chair.

Congressman Charles R. Thomas, of New Bern, was the first speaker, and in a very able address pledged his support to the drainage work in North Carolina, promising to use his influence towards the furtherance of this cause. He expressed himself as very much pleased at the work done since the last convention.

The chairman then called upon Mr. Ernest M. Green, chairman, for the report of the Committee on Resolutions, who reported as follows:

REPORT OF COMMITTEE ON RESOLUTIONS.

Whereas, the reclamation of our swamp and overflowed lands by drainage and the drainage of our wet land now under cultivation which have been insufficiently drained constitute one of the most important problems confronting the people of North Carolina and the country at large. There are in this State about 2,800,000 acres of unreclaimed swamp land which has heretofore been regarded as having no value except for the timber thereon, and in many instances the timber is of little value because of the amount of water upon the land and the consequent expense of removing the same. It is now known by recent investigation that at least 1,000,000 acres of this land may be drained and reclaimed and subjected to cultivation, and that it comprises as fertile soil as exists in any section of the country.

And *whereas,* one of the obstacles to successful farming is the insufficient drainage of lands which have been for many years under cultivation. The production of crops upon such lands is so uncertain and hazardous as seriously to diminish profits and impair the value of such lands. This insufficiently drained land, at the lowest estimate, comprises an area of more than double the unreclaimed lands, representing an annual loss and drain upon the State's resources aggregating a very large sum. There is scarcely a county in the whole State of North Carolina which does not contain areas of imperfectly drained land.

And *whereas,* in many cases, as stated, this character of land has been under cultivation for many generations, and it may be well to inquire why they have been permitted to remain undrained, thereby diminishing their productive capacity and impairing their value. There is a reason for this which may probably be expressed in the statement that individual landowners could not alone effectively drain their lands, but that co-operation was necessary in the formation of drainage districts, and that no legal machinery had been provided for this co-operative method.

And *whereas*, the object of this Drainage Association is to promote in every possible way the movement which shall result in the drainage of lands, either unreclaimed or heretofore reclaimed, we emphasize the statement that the work of this Association is confined to no particular section, but embraces the entire State. We further wish to emphasize the statement that efficient drainage is at the base of successful farming. A most important movement is now in progress seeking to inculcate better farm methods and more intelligent knowledge of the soil and plant life. Every other requisite in successful farming may be applied, the individual farmer may be trained and skilled as he ought to be, and yet he cannot produce crops unless his lands are well drained: Therefore,

Resolved, That we thank the General Assembly of 1909 for enacting a modern drainage law in form substantially as recommended at the last session of this Drainage Association. We believe that this law contains the essential procedure whereby lands may be drained in large areas upon the co-operative plan and upon an economical basis.

Resolved, That we urge the General Assembly at its next session to enact a law authorizing the State Geological and Economic Survey to employ a competent drainage engineer, under the supervision of the State Geologist, who may be employed in visiting sections where drainage is necessary and confer with the landowners and make preliminary investigations and giving assistance in other respects to this work, and that necessary appropriation be made to the Geological Survey for salary and expenses of said engineer. We also urge that body to make the necessary appropriation whereby the compensation of the drainage engineer appointed in drainage proceedings may be advanced and paid preliminarily by the State Geological and Economic Survey as heretofore authorized by existing law. We regard both of these provisions as very necessary for the best administration of the law.

Resolved, That we also urge the General Assembly to support by liberal appropriations the State Geological and Economic Survey and all other departments of the State Government which have been created for the purpose of promoting agriculture and industrial development of the State in all lines of endeavor. With liberal appropriations and with trained, efficient public servants to administer the law and expend the money, a strong impetus will be given and greater progress made in the development of our resources.

Resolved, That we urge upon the members of this Association and its officers and upon the progressive citizens everywhere the importance of aiding in this educational movement for the drainage of our lands. Agitation and education by the holding of meetings in our rural sections will gradually create such intelligent sentiment and knowledge as will result in the drainage of all our lands, and consequently in greatly augmenting the prosperity and wealth of our people. We urge upon our efficient State Geologist that within the limitations imposed upon him that he render every possible aid in affording instruction to the people upon this subject.

Resolved, That we express our gratitude to the United States Department of Agriculture, under the able administration of Secretary James Wilson, for the substantial aid which has been rendered by that department in co-operating with the State of North Carolina. In this connection we have peculiar pleasure in mentioning the name of C. G. Elliott, Chief of the Bureau of Drainage Investigations in that department, who has at all times evinced an interest in the drainage of our lands and through whom have been made many preliminary investigations and actual detailed surveys and estimates of costs by the trained corps of engineers in his bureau. Without the aid of that bureau much less progress would have been made in the formation of drainage districts. In this connection we cannot refrain from expressing our appreciation of the work done by Mr. J. O. Wright, Supervising Drainage Engineer of the Bureau of Drainage Investigations. He is not only a trained engineer and has not only performed his official duty, but he has exhibited a degree of zeal and personal interest in our people and in the promotion of this movement which arouses our warmest commendation and gratitude. Our thanks are also extended to Mr. L. W. Page, Chief of the Office of Public Roads of the United States Department of Agriculture, for detailing Mr. M. O. Eldridge to attend this convention, who has delivered a most interesting lecture upon the important relation between drainage and public roads. We also thank Mr. Gifford Pinchot, Chief Forester of the United States Department of Agriculture, for detailing Mr. Bristow Adams to that service, who has delivered a most instructive lecture upon the relation of forestry and other resources to drainage.

Resolved, That we extend thanks to the Secretary of the Treasury and to Capt. Worth G. Ross, Chief of the Revenue Cutter Service, for the courtesy extended in placing the revenue cutter "Pamlico" at the disposition of the delegates to this convention for a most delightful trip down Neuse River. To Hon. Charles R. Thomas we are indebted for his intervention in this behalf, and also to the officers and crew of the steamer, for their kind consideration and courtesies.

Resolved, That we extend thanks to the Board of Commissioners of Craven County for the use of the courthouse for this convention. We wish especially to thank the honorable Mayor and Board of Aldermen and the Chamber of Commerce for the delightful reception to the delegates tendered in the beautiful hall in the Elks Building, which structure would be creditable to a city much larger than the city of New Bern. And to the citizens of New Bern generally we extend thanks for their numerous and thoughtful courtesies. To the officers of this Association for the past year, who have given loyal and valuable service to the same, we wish to make acknowledgment and tender our thanks.

Resolved, That we thank the press of the State for the publicity and educational work which they have contributed to the cause. The continued success of this movement depends in a large degree upon the extent to which the members of the press shall aid. Publicity and education are two prime essentials upon which the success of this economic movement depend, and no other factor can contribute more in this respect than the press of the State.

Finally, we congratulate the people of the State upon the progress which has been made since the passage of the general drainage law in March of the present year. At least twelve proceedings have been instituted with a view of organizing drainage districts under that law, and landowners in many other sections are agitating the subject with a view of organizing other districts. We confidently predict that before the next meeting of this Association we will be able to report that a gratifying number of districts have been actually formed, the bonds sold, contracts consummated and the work of construction under way and completed, thereby affording object-lessons for the encouragement of other sections.

E. M. GREEN, *Chairman.*

The report of this committee was accepted and unanimously adopted.

DISCUSSION OF NORTH CAROLINA DRAINAGE LAW.

The convention then took up the discussion of the North Carolina Drainage Law. This discussion was led by Mr. Ernest M. Green, who introduced the bill into the House during the Legislature of 1909 and worked so vigorously for its passage. He stated at the outset that he had not heard of any adverse criticism regarding the law, except that relating to the payment of the engineers for the preliminary survey. The act authorized the State Geologist to pay for this preliminary work, but without making any appropriation to provide him with funds for the purpose. This made it necessary for the petitioners for the drainage district to advance the money for this preliminary work, or for the drainage engineer himself to advance this money, the bond filed by the petitioners being security for reimbursement.

The different sections of the law were taken up and discussed, the following delegates entering into the discussion: Charles R. Thomas, Patrick Matthew, C. R. Humphries, B. F. Keith, Joseph Hyde Pratt, Joseph A. Brown, and Lawrence Brett.

At the close of this discussion the chairman made a short address to the delegates regarding the future work of the Association, urging all the delegates to carry on the work in their own counties. He stated that the Association was interested not only in the drainage of swamp and overflowed lands, but also in the drainage of high lands and tile drainage of all farm lands where such drainage was needed. He stated that if we could have charts and maps prepared showing exact plans of drainage, and have these hung in the schoolhouses of North Carolina, he thought considerable good could be done towards educating the people as to how to drain their land. He stated further that considerable education was needed regarding bond issues and the value of drainage, and that he, for one, was willing to make addresses on these subjects whenever called upon, and that he hoped all the delegates would also be ready to respond, whenever possible, to do this same kind of educationa work.

At the close of Mr. Brown's address the convention adjourned *sine die*

COUNTIES REPRESENTED AT CONVENTION.

The following counties were represented at the convention: Beaufort, Bladen, Carteret, Chowan, Columbus, Craven, Currituck, Duplin, Guilford, Hertford, Hyde, Jones, New Hanover, Orange, Pamlico, Pasquotank, Pender, Pitt, Robeson, Wake, Washington and Wilson.

NORTH CAROLINA DRAINAGE LAW.

[CHAPTER 442, LAWS OF 1909.]

AN ACT TO PROMOTE THE PUBLIC HEALTH, CONVENIENCE AND WELFARE BY LEVEEING, DITCHING AND DRAINING THE WET, SWAMP AND OVERFLOWED LANDS OF THE STATE, AND PROVIDING FOR THE ESTABLISHMENT OF LEVEE OR DRAINAGE DISTRICTS FOR THE PURPOSE OF ENLARGING OR CHANGING ANY NATURAL WATER COURSES, AND FOR DIGGING DITCHES OR CANALS FOR SECURING BETTER DRAINAGE OR PROVIDING BETTER OUTLETS FOR DRAINAGE, FOR BUILDING LEVEES OR EMBANKMENTS AND INSTALLING TIDE GATES OR PUMPING PLANTS FOR THE RECLAMATION OF OVERFLOWED LANDS, AND PRESCRIBING A METHOD FOR SO DOING; AND PROVIDING FOR THE ASSESSMENT AND COLLECTION OF THE COST AND EXPENSE OF THE SAME, AND ISSUING AND SELLING BONDS THEREFOR, AND FOR THE CARE AND MAINTENANCE OF SUCH IMPROVEMENTS, WHEN CONSTRUCTED.

The General Assembly of North Carolina do enact:

SECTION 1. *Duty and powers of the court.*

Jurisdiction of clerk of superior court. Levee or drainage districts.

The clerk of the Superior Court of any county in the State of North Carolina shall have jurisdiction, power and authority to establish a levee or drainage district or districts in his county, and to locate and establish levees, drains or canals, and cause to be constructed, straightened, widened or deepened any ditch, drain or water course, and to build levees or embankments and erect tide gates and pumping plants for the purpose of draining and reclaiming wet, swamp or overflowed lands; and it is hereby declared that the drainage of swamps and the drainage of the surface water from agricultural lands and the reclamation of tidal marshes shall be considered a public benefit and conducive to the public health, convenience, utility and welfare.

Drainage a public benefit.

SEC. 2. *Petition—Bond—Board of viewers.*

Petition for establishment of drainage district.

Whenever a petition signed by a majority of the resident landowners in a proposed drainage district or by the owners of three-fifths of all the land which will be affected by or assessed for the expense of the proposed improvements shall be filed in the office of the clerk of the Superior Court of any county in which a part of said lands are located, setting forth that any specific body or district of land in the county and adjoining counties, described in such a way as to convey an intelligent idea as to the location of such land, is subject to overflow or too wet for cultivation, and the public benefit or utility or the public health, convenience or welfare will be promoted by draining, ditching or leveeing the same or by changing or improving the natural water courses, and setting forth therein, as far as practicable, the starting point, route and

Bond for cost of proceedings.

Summons to be served on landowners.

Appointment of board of viewers.

Appointment and payment of drainage engineer.

Jurisdiction when land is in more than one county.

Rules of proceeding.

Summons served by publication.

terminus and lateral branches, if necessary, of the proposed improvement, and there is filed therewith a bond for the amount of fifty dollars per mile for each mile of the ditch or proposed improvement, signed by two or more sureties or by some lawful and authorized surety company, to be approved by the clerk of the Superior Court and conditioned for payment of all costs and expenses incurred in the proceedings in case the court does not grant the prayer of said petition, the said clerk shall issue a summons to be served on all the defendant landowners who have not joined in the petition and whose lands are included in the proposed drainage district. Upon the return day the said clerk shall appoint a disinterested and competent civil and drainage engineer and two resident freeholders of the county or counties in which said lands are located as a board of viewers to examine the lands described in the petition and make a preliminary report thereon. Such drainage engineer shall be appointed upon the recommendation of the State Geologist, and the compensation for the services of such engineer and his necessary assistants, to be fixed as herein provided, shall be paid by the State Geological and Economic Survey, said sum or sums so paid to be refunded when the drainage fund is subsequently provided by the sale of bonds or otherwise. When the lands proposed to be drained and created into a drainage district are located in two or more counties the clerk of the Superior Court of either county shall have and exercise the jurisdiction herein conferred, and the venue shall be in that county in which the petition is first filed. The law and rules regulating special proceedings shall be applicable to this act, so far as may be practicable. The summons may be served by publication as to any defendants who cannot be personally served as provided by law.

Sec. 3. *Examination—Preliminary report.*

Board of viewers to examine lands and route.

Surveys.

The board of viewers shall proceed to examine the land described in said petition, and other land if necessary to locate properly such improvement or improvements as are petitioned for, along the route described in the petition, or any other route answering the same purpose if found more practicable or feasible, and may make surveys such as may be necessary to determine the boundaries and elevation of the several parts of the district, and shall make and return to the clerk of the Superior Court within thirty days, unless the time shall be extended by the court, a written report, which shall set forth:

Report to set forth:
If drainage is practicable;
If drainage will benefit public health or any public highway or conduce to general welfare.
If drainage will benefit the specific lands;
If all lands to be benefited are included.

1. Whether the proposed drainage is practicable or not.
2. Whether it will benefit the public health or any public highway or be conducive to the general welfare of the community.
3. Whether the improvement proposed will benefit the lands sought to be benefited.
4. Whether or not all the lands that are benefited are included in the proposed drainage district.

They shall also file with this report a map of the proposed drainage district, showing the location of the ditch or ditches or other improvement to be constructed and the lands that will be affected thereby, and such other information as they may have collected that will tend to show the correctness of their findings.

Map to be filed.

Other information.

SEC. 4. *Filing preliminary report.*

The clerk of the Superior Court shall consider this report. If the viewers report that the drainage is not practicable or that it will not benefit the public health or any public highway or be conducive to the general welfare of the community, and the court shall approve such findings, the petition shall be dismissed at the cost of the petitioners. Such petition or proceeding may again be instituted by the same or additional landowners at any time after six months, upon proper allegations that conditions have changed or that material facts were omitted or overlooked. If the viewers report that the drainage is practicable and that it will benefit the public health or any public highway or be conducive to the general welfare of the community, and the court shall so find, then the court shall fix a day when the report will be further heard and considered.

Clerk to consider report.

Petition dismissed if work not reported practicable and beneficial.

Petition renewed after six months.

Day for further hearing if report be favorable.

SEC. 5. *Notice.*

If the petition is entertained by the court, notice shall be given by publication for two consecutive weeks in some newspaper of general circulation within the county or counties, if one shall be published in such counties, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places within the drainage district that on the date set, naming the day, the court will consider and pass upon the report of the viewers. At least fifteen days shall intervene between the date of the publication and the posting of the notices and the date set for the hearing.

Notice of hearing.

Time of notice.

SEC. 6. *Hearing preliminary report.*

At the date appointed for the hearing the court shall hear and determine any objections that may be offered to the report of the viewers. If it appear that there is any land within the proposed levee or drainage district that will not be affected by the leveeing or drainage thereof, such lands shall be excluded and the names of the owners withdrawn from such proceeding; and if it shall be shown that there is any land not within the proposed district that will be affected by the construction of the proposed levee or drain, the boundary of the district shall be so changed as to include such land, and such additional landowners shall be made parties plaintiff or defendant, respectively, and summons shall issue accordingly, as hereinbefore provided. After such change in the boundary is made, the sufficiency of the petition shall be verified, to determine whether or not it conforms to the requirements of the statute as provided in section two. The efficiency of the drainage or levees may also be determined, and if it appears that

Court to hear and determine objections.

Amendments to petition and changes in boundary and location.

Board of viewers may attend hearing.
Reference of petition for further report.
Establishment of district.
Name or number.

the location of any levee or drain can be changed so as to make it more effective, or that other branches or spurs should be constructed, or that any branch or spur projected may be eliminated or other changes made that will tend to increase the benefits of the proposed work, such modification and changes shall be made by the board. The engineer and the other two viewers may attend this meeting and give any information or evidence that may be sought to verify and substantiate their report. If necessary, the petition, as amended, shall be referred by the court to the engineer and two viewers for further report. The above facts having been determined to the satisfaction of the court, and the boundaries of the proposed district so determined, it shall declare the establishment of the drainage or levee district, which shall be designated by a name or number, for the object and purpose as herein set forth.

Sec. 7. *May condemn land.*

Power to condemn land.
Procedure for condemnation.
Payment of damages.

If it shall be necessary to acquire a right of way or an outlet over and through lands not affected by the drainage, and the same cannot be acquired by purchase, then and in such event the power of eminent domain is hereby conferred, and the same may be condemned. Such owner or owners of the land proposed to be condemned may be made parties defendant in the manner of an ancillary proceeding, and the procedure shall be substantially as provided for the condemnation of rights of way for railroads in chapter sixty-one of the Revisal of one thousand nine hundred and five, so far as the same may be applicable, and such damages as may be awarded as compensation shall be paid by the board of drainage commissioners out of the first funds which shall be available from the proceeds of sale of bonds or otherwise.

Sec. 8. *Right of appeal.*

Appeal to superior court.
Bond on appeal.

Any person or corporation owning lands within the drainage or levee district which he or it thinks will not be benefited by the improvement and should not be included in the district may appeal from the decision of the court to the Superior Court of such county, in term time, by filing an appeal, accompanied by a bond conditioned for the payment of the costs, if the appeal should be decided against him, for such sum as the court may require, not exceeding two hundred dollars, signed by two or more solvent sureties, or in some approved surety company, to be approved by the court.

Sec. 9. *Complete survey.*

Report referred for complete survey.
Complete report within sixty days.

After the district is established the court shall refer the repor of the engineer and viewers back to them to make a complet survey, plans and specifications for the drains or levees or othe improvements, and fix a time when said engineer and viewers shal complete and file their report, not exceeding sixty days.

SEC. 10. *Complete report.*

The engineer and viewers shall have power to employ such assistants as may be necessary to make a complete survey of the drainage district, and shall enter upon the ground and make a survey of the main drain or drains and all its lateral. The line of each ditch, drain or levee shall be plainly and substantially marked on the ground. The course and distance of each ditch shall be carefully noted and sufficient notes made, so that it may be accurately plotted and mapped. A line of levels shall be run for the entire work and sufficient data secured from which accurate profiles and plans may be made. Frequent bench marks shall be established along the line, on permanent objects, and their elevation recorded in the field books. If it is deemed expedient by the engineer and viewers, other levels may be run to determine the fall from one part of the district to another. If an old water course, ditch or channel is being widened, deepened or straightened, it shall be accurately cross-sectioned, so as to compute the amount of cubic yards saved by the use of such old channel. A drainage map of the district shall then be completed, showing the location of the ditch or ditches and other improvements and the boundary, as closely as may be determined by the records of the lands owned by each individual landowner within the district. The location of any railroads or public highways and the boundary of any incorporated towns or villages within the district shall be shown on the map. There shall also be prepared to accompany this map a profile of each levee, drain or water course, showing the surface of the ground, the bottom or grade of the proposed improvement and the number of cubic yards of excavation or fill in each mile or fraction thereof, and the total yards in the proposed improvement and the estimated cost thereof, and plans and specifications, and the cost of any other work required to be done.

Board of viewers may employ assistants.

Survey of main drain and laterals.

Detailed instructions for making survey.

Drainage map to be drawn. Details of map.

Profile to accompany map.

Estimate of cost.

Plans, specifications and cost of other work.

SEC. 11. *Assessment of damages.*

It shall be the further duty of the engineer and viewers to assess the damages claimed by anyone that is justly right and due to them for land taken or for inconvenience imposed because of the construction of the improvement, or for any other legal damages sustained. Such damage shall be considered separate and apart from any benefit the land would receive because of the proposed work, and shall be paid by the board of drainage commissioners when funds shall come into their hands.

Board of viewers to assess claims for damages.

Benefits not considered.

Payment of damages.

SEC. 12. *Classification of land according to benefits.*

It shall be the further duty of the engineer and viewers to personally examine the land in the district and classify it with reference to the benefit it will receive from the construction of the levee, ditch, drain or water course or other improvement. In the case of drainage, the degree of wetness of the land, its proximity to the ditch or a natural outlet and the fertility of the

Board of viewers to examine and classify lands.

Considerations in determining benefit.

Land in five classes, "A," "B," "C," "D," and "E."

Number of acres in each class ascertained.

Total acreage.

Scale of assessment.

soil shall be considered in determining the amount of benefit it will receive by the construction of the ditch. The land benefited shall be separated in five classes. The land receiving the highest benefit shall be marked "Class A"; that receiving the next highest benefit, "Class B"; that receiving the next highest benefit, "Class C"; that receiving the next highest benefit, "Class D," and that receiving the smallest benefit, "Class E." The holdings of any one landowner need not necessarily be all in one class, but the number of acres in each class shall be ascertained, though its boundary need not be marked on the ground or shown on the map. The total number of acres owned by one person in each class and the total number of acres benefited shall be determined. The total number of acres of each class in the entire district shall be obtained and presented in tabulated form. The scale of assessment upon the several classes of land returned by the engineer and viewers shall be in the ratio of five, four, three, two and one; that is to say, as often as five mills per acre is assessed against the land in "Class A," four mills per acre shall be assessed against the land in "Class B," three mills per acre in "Class C," two mills per acre in "Class D," and one mill per acre in "Class E." This shall form the basis of the assessment of benefits to the lands for drainage purposes.

SEC. 13. *Cost of the survey.*

Account kept and reported to court.

The engineer and viewers shall keep an accurate account and report to the court the name and number of days each person was employed on the survey and the kind of work he was doing and any expenses that may have been incurred in going to and from the work, and the cost of any supplies or material that may have been used in making the survey.

SEC. 14. *Delay—Extension of time.*

Court may extend time for cause shown.

In case the work is delayed by high water, sickness or any other good cause, and the report is not completed at the time fixed by the court, the engineer and viewers shall appear before the court and state in writing the cause of such failure and ask for sufficient time in which to complete the work, and the cour shall set another date by which the report shall be completed and filed.

SEC. 15. *Final report—Notice of hearing.*

Examination of final report.

Time for final hearing.

Notice of final hearing.

When the final report is completed and filed it shall be examine by the court, and if it is found to be in due form and in accordanc with the law it shall be accepted, and if not in due form i may be referred back to the engineer and viewers, with instructions to secure further information, to be reported at a subsequen date to be fixed by the court. When the report is fully complete and accepted by the court a date not less than twenty days thereafter shall be fixed by the court for the final hearing upon th report, and notice thereof shall be given by publication in a news

aper of general circulation in the county and by posting a written
r printed notice on the door of the courthouse and at five con-
picuous places throughout the district, such publication to be made
or at least two weeks before the final hearing. During this time
. copy of the report shall be on file in the office of the clerk of
he Superior Court and shall be open to the inspection of any
andowner or other person interested within the district.

Time of publication.
Report open to inspection.

SEC. 16. *Adjudication—Final report.*

At the date set for hearing any landowner may appear in per-
on or by counsel and file his objection in writing to the re-
ort of the viewers; and it shall be the duty of the court to
arefully review the report of the viewers and the objections filed
hereto, and make such changes as are necessary to render sub-
tantial and equal justice to all the landowners in the district.
f, in the opinion of the court, the cost of construction, together
vith the amount of damages assessed, is not greater than the
enefits that will accrue to the land affected, the court shall con-
rm the report of the viewers. If, however, the court finds that
he cost of construction, together with the damages assessed, is
reater than the resulting benefit that will accrue to the lands
ffected, the court shall dismiss the proceedings at the cost of the
etitioners, and the sureties upon the bond so filed by them shall
e liable for such costs: *Provided,* that the State Geological and
conomic Survey may remit and release to the petitioners the
osts expended by said board on account of the engineer and his
ssistants. The court may from time to time collect from the
etitioners such amounts as may be necessary to pay costs accru-
ng, other than costs of the engineer and his assistants, such
mounts to be repaid from the special tax hereby authorized.

Landowners may appear in person or by counsel.
Objections in writing.
Court to review report and objections.
Confirmation of report.
Dismissal of proceedings.
Proviso: release of costs of engineer and assistants.
Payments on costs.

EC. 17. *Appeal.*

Any party aggrieved may, within ten days after the confirmation
f the assessor's report, appeal to the Superior Court in term time.
uch appeal shall be taken and prosecuted as now provided in
pecial proceedings.

Appeal to superior court.

EC. 18. *Drainage record.*

The clerk of the Superior Court shall provide a suitable book,
be known as the "drainage record," in which he shall transcribe
very petition, motion, order, report, judgment or finding of the
oard in every drainage transaction that may come before it,
such a manner as to make a complete and continuous record
the case. Copies of all the maps and profiles are to be furnished
the engineer and marked by the clerk "official copies," which
hall be kept on file by him in his office, and one other copy shall
pasted or otherwise attached to his record book.

Drainage record.
Copies of maps and profiles kept on file.
Copy attached to record book.

SEC. 19. After the said drainage district shall have been declared
tablished, as aforesaid, and the survey and plan therefor ap-
roved, the court shall appoint three persons, who shall be desig-

Board of drainage commissioners.

Election by landowners.
Appointment by court.
Vacancies.
Drainage commissioners incorporated.
Corporate name.
Corporate powers.
Organization.
Treasurer.
Seal.

nated as the board of drainage commissioners. Such drainag commissioners shall first be elected by the owners of land with the drainage or levee district, or by a majority of same, in su manner as the court shall prescribe. The court shall appoi those receiving a majority of the votes. If any one or more such proposed commissioners shall not receive the vote of majority of such landowners the court shall appoint all or th remainder from among those voted for in the election. An vacancy thereafter occurring shall be filled in like manner. Su three drainage commissioners, when so appointed, shall be immediately created a body corporate under the name and style "The Board of Drainage Commissioners of ....Distric with the right to hold property and convey the same, to sue a be sued, and shall possess such other powers as usually perta to corporations. They shall organize by electing from among the number a chairman and a vice chairman. They shall also elect secretary, either within or without their body. The treasur of the county in which the proceeding was instituted shall be *officio* treasurer of such drainage commissioners. Such board drainage commissioners shall adopt a seal, which they may alter pleasure. The board of drainage commissioners shall have a possess such powers as are herein granted. The name of su drainage district, whether designated by number or otherwi shall constitute a part of its corporate name; for illustrati "The Board of Drainage Commissioners of (No. 1 or Moyoc District."

Sec. 20. *Superintendent of construction.*

Superintendent of construction.
Bond of superintendent.

The board of drainage commissioners shall appoint a compete person as superintendent of construction. Such person shall f nish a bond, to be approved by the commissioners, in the pe sum of ten thousand dollars, conditioned upon the honest a faithful performance of his duties, such bond to be in favor the board of drainage commissioners.

Sec. 21. *Notice of letting contract—Bond.*

Advertisement for letting of contracts.
Work let to lowest bidder.
Bids exceeding estimate not considered.
Right to reject all bids.

The board of drainage commissioners shall cause notice to given for two consecutive weeks in some newspaper publish in the county wherein such improvement is located, if such th be, and such additional publication elsewhere as they may de expedient, of the time and place of letting the work of constr tion of said improvement, and in such notice they shall specify approximate amount of work to be done and the time fixed for completion thereof; and in the date appointed for the letting, th together with the superintendent of construction, shall conv and let to the lowest responsible bidder, either as a whole or sections, as they may deem most advantageous for the distr the proposed work. No bid shall be entertained that exceeds estimated cost, except for good and satisfactory reasons it shall shown that the original estimate was erroneous. They shall h the right to reject all bids and advertise again the work, if heir judgment the interest of the district will be subserved by loing so. The successful bidder shall be required to enter into a ontract with the board of drainage commissioners and to execute bond for the faithful performance of such contract, with suffi-ient sureties, in favor of the board of drainage commissioners or the use and benefit of the levee or drainage district, in an mount equal to twenty-five per centum of the estimated cost of he work awarded to him.

Successful bidder to enter into contract and give bond.

EC. 22. *Payment for work done.*

The superintendent in charge of construction shall make monthly stimates of the amount of work done, and furnish one copy to he contractor and file the other with the secretary of the board f drainage commissioners against such contractor and his bond ve days after the filing of such estimate, meet and direct the ecretary to draw a warrant in favor of such contractor for ninety er centum of the work done, according to the specifications and ontract; and upon the presentation of such warrant, properly gned by the chairman and secretary, to the treasurer of the drain-ge fund, he shall pay the amount due thereon. When the work fully completed and accepted by the superintendent he shall ake an estimate for the whole amount due, including the amounts ithheld on the previous monthly estimates, which shall be paid om the drainage fund as before provided.

Superintendent to make and file monthly estimates.
Warrants for payments.

Payment of warrants.

Payment in full on completion of work.

EC. 23. *Failure of contractor—Reletting.*

If any contractor to whom a portion of said work shall have een let shall fail to perform the same according to the terms pecified in his contract, action may be had in behalf of the board drainage commissioners against such contractor and his bond the Superior Court for damages sustained by the levee or drain-ge district, and recovery made against such contractor and his ureties. In such an event the work shall be advertised and relet the same manner as the original letting.

Suit on bond of contractor.

Work advertised and relet.

EC. 24. *Right of contractor.*

In the construction of the work the contractor shall have the ght to enter upon the lands necessary for this purpose and the ght to remove private or public bridges or fences and to cross ivate lands in going to or from the work. In case the right of ay of the improvement is through timber the owner thereof all have the right to remove it, if he so desires, before the work construction begins, and in case it is not removed by the land-vner it shall become the property of the contractor and may be moved by him.

Right of contractor to enter on lands.

Removal and ownership of timber.

C. 25. *Highways affected.*

Where any public ditch, drain or water course established under e provisions of this act crosses a public highway the actual st of constructing the same across the highway or removing old idges or building new ones shall be paid for from the fund of

Cost of drains across highways.

Highways benefited to be included in report.

the drainage district. Wherever any highway within the levee or drainage district shall be beneficially affected by the construction of any improvement or improvements in such district it shall be the duty of the viewers appointed to classify the land to give in their report the amount of benefit to such highway, and notice shall be given by the clerk of the Superior Court to the clerk of the board of county commissioners in the county where the road is located of the amount of such assessment, and the county commissioners shall have the right to appear before the court and file its objections, the same as any landowner.

Notice of assessment on highways.

Sec. 26. *Railroad—Damage—Benefit.*

Procedure to determine place and manner of crossing right of way of railroad companies.

Whenever the engineer and the viewers in charge shall make a survey for the purpose of locating a public levee or drainage district or changing a natural water course, and the same would cross the right of way of any railroad company, it shall be the duty of the owner in charge of the work to notify the railroad company, by serving written notice upon the agent of such company or its lessee or receiver, that they will meet the company at the place where the proposed ditch, drain or water course crosses the right of way of such company, said notice fixing the time of such meeting, which shall not be less than ten days after the service of the same, for the purpose of conferring with said railroad company with relation to the place where and the manner in which such improvement shall cross such right of way. When the time shall arrive fixed for such conference, unless for good cause more time is agreed upon, it shall be the duty of the viewers in charge and the railroad company to agree, if possible, upon the place where and the manner and method in which such improvement shall cross such right of way. If the viewers in charge and the railroad company cannot agree, or if the railroad company shall fail, neglect or refuse to confer with the viewers, they shall determine the place and manner of crossing the right of way of said railroad company, and shall specify the number and size of openings required, and the damages, if any, to said railroad company, and so specify in their report. The fact that the railroad company is required by the construction of the improvement to build a new bridge or culvert or to enlarge or strengthen an old one shall not be considered as damages to said railroad company. The engineer and viewers shall also assess the benefits that will accrue to the right of way, roadbed and other property of said company by affording better drainage or a better outlet for drainage, but no benefits shall be assessed because of the increase in business that may come to said road because of the construction of the improvement. The benefits shall be assessed at a fixed sum, determined solely by the physical benefit that its property will receive by the construction of said improvement, and it shall be reported by the viewers as a special assessment, due personally from the railroad company as a special assessment; it may be collected in the manner of an ordinary debt in any court having jurisdiction.

Agreement.

Procedure in case of disagreement.

Facts not considered as damages.

Benefits to be assessed.

Assessment at a fixed sum.

SEC. 27. *Notice to railroad.*

Notice of final hearing to be served on railroad company.

The clerk of the Superior Court shall have notice served upon the railroad company of the time and place of the meeting to hear and determine the final report of the engineer and viewers, and the said railroad company shall have the right to file objections to said report and to appeal from the findings of the board of commissioners in the same manner as any landowner. But such an appeal shall not delay or defeat the construction of the improvement.

SEC. 28. *Manner of crossing right of way—Penalty for delay—Cost.*

Notice to railroad company of time of work.

Time to be agreed on.

Railroad company to remove obstructions.

Refusal to remove obstructions and permit work a delay of construction.

Penalty.

Railroad company to present itemized bill.

Superintendent to audit bill.

Cost of excavation deducted and bill paid.

After the contract is let and the actual construction is commenced, if the work is being done with a floating dredge, the superintendent in charge of construction shall notify the railroad company of the probable time at which the contractor will be ready to enter upon the right of way of said road and construct the work thereon. It shall be the duty of said railroad to send a representative to view the ground with the superintendent of construction and arrange the exact time at which such work can be most conveniently done. At the time agreed upon the said railroad company shall remove its rails, ties, stringers and such other obstructions as may be necessary to permit the dredge to excavate the channel across its right of way. The work shall be so planned and conducted as to interfere in the least possible manner with the business of said railroad. In case the railroad company refuses and fails to remove its track and allow the dredge to construct the work on its right of way it shall be held as delaying the construction of the improvement, and such company shall be liable to a penalty of twenty-five dollars per day for each day of delay, to be collected by the board of drainage commissioners for the benefit of the drainage district as in the case of other penalties. Such a fine may be collected in any court having jurisdiction and shall inure to the benefit of the drainage district. Within thirty days after the work is completed, an itemized bill for the actual expenses incurred by the railroad company for opening its tracks shall be made and presented to the superintendent of construction of the drainage improvement. Such bill, however, shall not include the cost of putting in a new bridge or strengthening or enlarging an old one. The superintendent of construction shall audit this bill and, if found correct, approve the same and file it with the secretary of the board of drainage commissioners. The commissioners shall deduct from this bill the cost of the excavation done by the dredge on the right of way of said railroad company at the contract price, and pay the difference, if any, to said railroad company.

SEC. 29. *Control and repairs.*

Completed work to be under control of drainage commissioners.

Duty to maintain work.

Whenever any improvement constructed under this act is completed it shall be under the control and supervision of the board of drainage commissioners. It shall be the duty of the said

Assessment for maintenance and repairs.

board to keep the levee, ditch, drain or water course in good repair, and for this purpose they may levy an assessment on the lands benefited by the construction of such improvement in the same manner and in the same proportion as the original assessments were made, and the fund that is collected shall be used for repairing and maintaining the ditch, drain or water course in perfect order: *Provided, however*, that if any repairs are made necessary by the act or negligence of the owner of any land through which such improvement is constructed or by the act or negligence of his agent or employee, or if the same is caused by the cattle, hogs or other stock of said owner, employee or agent, then the cost thereof shall be assessed and levied against the lands of said owner alone, to be collected by proper suit instituted by the drainage commissioners. It shall be unlawful for any person to injure or damage or obstruct or build any bridge, fence or flood gate in such a way as to injure or damage any levee, ditch, drain or water course constructed or improved under the provisions of this act and any person causing such injury shall be guilty of a misdemeanor, and upon conviction thereof may be fined in any sum no exceeding twice the damage or injury done or caused.

Proviso: repairs made necessary by negligence.

Injury to works a misdemeanor.

Punishment.

Sec. 30. *Outlet for lateral drains.*

Rights of owners of assessed lands.

Procedure for condemnation of access to drain.

The owner of any land that has been assessed for the cost o the construction of any ditch, drain or water course, as herei provided, shall have the right to use the ditch, drain or wate course as an outlet for lateral drains from said land; and if sai land is separated from the ditch, drain or water course by th land of another or others, and the owner thereof shall be unabl to agree with said other or others as to the terms and condition on which he may enter their lands and construct said drain o ditch, he may file his ancillary petition in such pending procee ing to the court, and the procedure shall be as now provided b law. When the ditch is constructed it shall become a part of th drainage system and shall be under the control of the board c drainage commissioners and be kept in repair by them as herei provided.

Sec. 31. *Assessment-tax roll.*

Drainage commissioners to prepare assessment-tax roll.

Ascertainment of amount to be assessed.

Assessment proportioned to benefits.

After the classification of the land and the ratio of assessme of the different classes to be made thereon has been confirme by the court, the drainage commissioners shall prepare an asses ment roll or drainage-tax duplicate, giving a description of all th land in said drainage district, the name of the owner, so far as ca be ascertained from the public records, and the amount of asses ment against each of the several tracts of land. In preparing th assessment roll the board shall ascertain the total cost of the i provement, including the damages awarded and to be paid to th owners of land, and all incidental expenses, and deduct therefro any special assessment made against any railroad or highway, a the remainder shall be the amount to be borne and paid by th lands benefited. This amount shall be assessed against the sever tracts of land according to the benefit received, as shown by the classification and ratio of assessment made by the viewers and confirmed by the board of drainage commissioners. This drainage-tax roll shall be made in duplicate, signed by the chairman and secretary, and one copy filed with the drainage record and the other delivered to the sheriff or other county tax collector. There shall be appended an order to collect the said assessments, and the same shall have the force and effect of a judgment as in the case of State and county taxes.

Drainage-tax roll in duplicate.

Order to collect assessment.

Sec. 32. *Time of payment.*

If the total cost of the work is less than an average of twenty-five cents per acre on all the land in the district the assessment made against the several tracts shall be collected in one installment, by the same officer and in the same manner as State and county taxes are collected, and payable at the same time. In case the total assessment exceeds the average of twenty-five cents per acre on all the lands in the district the said board of drainage commissioners may give notice of three weeks by publication in some newspaper of general circulation in the district, if there be one, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places in the drainage district, that they propose to issue bonds for the construction of said improvement, giving the amount of bonds to be issued, the rate of interest they are to bear and the time when payable. Any landowner having lands assessed in the district and not wanting to pay interest on the bonds may, within thirty days after the publication of said notice, pay the county treasurer the full amount of his assessment and have his land released therefrom.

Assessment payable in one installment.

Advertisement of purpose to issue drainage bonds.

Land released on payment of assessment.

Sec. 33. *Defense—Waiver.*

Each and every person owning land in the district which is assessed for the construction of an improvement who shall neglect or fail to pay the full amount of his assessment to the county treasurer within the time specified shall be deemed as consenting to the issuing of said drainage bonds, and in consideration of the right to pay his assessment in installments he hereby waives his right to any defense against the collection of said assessment because of any irregularity, illegality or defect in the proceedings prior to this time, except in the case of an appeal, as heretofore provided, which is not affected by this waiver. The term "person," as used in this act, includes any firm, company or corporation.

Landowner failing to pay assessment held as consenting to bond issue.

Right of defense waived.

Sec. 34. *Bond issue.*

At the expiration of the thirty days after the publication the board of drainage commissioners may issue bonds for the full amount of the assessment not paid in to the county treasurer, together with the interest thereon, costs of collection or other incidental expenses. These bonds shall bear six per cent interest per annum, payable annually, and shall be paid in ten equal annual installments. The first installment of the principal shall mature

Bond issue authorized. Amount.

Interest.

Maturity.

First installment.

Sale of bonds.

Issue and record of bonds.

Lien for assessment paramount.

Collected as taxes.

Mandamus for levy of assessments to meet installments of bonds.

Suits on official bonds.

at the expiration of three years from the date of issue, and one installment each succeeding year for nine additional years. The commissioners may sell these bonds at not less than par and devote the proceeds to the payment of the work as it progresses. In no case shall bonds be issued until the tax levy has been made to meet them as they come due. The bonds issued shall be for the exclusive use of the levee or drainage district specified on their face, and should be numbered by the board of drainage commissioners and recorded in the drainage record, which record shall set out specifically the lands embraced in the district on which the tax has not been paid in full, and which land is assessed for the payment of the bonds issued and the interest thereon. This assessment shall constitute the first and paramount lien, second only to State and county taxes, upon the lands assessed for the payment of said bonds and the interest thereon as they become due, and shall be collected in the same manner by the same officers as the State and county taxes are collected. If any installment of principal or interest represented by the said bond shall not be paid at the time and in the manner when the same shall become due and payable, and such default shall continue for a period of six months, the holder or holders of such bond or bonds upon which default has been made may have a right of action against said drainage district or the board of drainage commissioners of said district, wherein the court may issue a writ of *mandamus* against the said drainage district, its officers, including the tax collector and treasurer, directing the levying of a tax or special assessment as herein provided, and the collection of same, in such sum as may be necessary to meet any unpaid installments of principal and interest and cost of action; and such other remedies are hereby vested in the holder or holders of such bond or bonds in default as may be authorized by law; and the right of action is hereby vested in the holder or holders of such bond upon which default has been made authorizing them to institute suit against any officer on his official bond for failure to perform any duty imposed by the provisions of this act. The official bonds of the tax collector and county treasurer shall be liable for the faithful performance of the duties herein assigned them. Such bonds may be increased by the board of county commissioners.

Sec. 35. *Relevy.*

Power to change or modify assessment.

Where the court has confirmed an assessment for the construction of any public levee, ditch or drain, and such assessment has been modified by the court of superior jurisdiction, but for some unforeseen cause it cannot be collected, the board of drainage commissioners shall have power to change or modify the assessment as originally confirmed to conform to the judgment of the Superior Court and to cover any deficit that may have been caused by the order of said court or unforeseen occurrence. The said relevy shall be made for the additional sum required, in the same rate on the lands benefited as the original assessment was made.

SEC. 36. *Fees and expenses.*

Any engineer employed under the provisions of this act shall receive such compensation per diem for his services as shall be fixed and determined by the drainage commissioners. The viewers, other than the engineer, shall receive three dollars per day; the rodmen, axmen, chainmen and other laborers shall receive not to exceed two dollars per day each. All other fees and costs incurred under the provisions of this act shall be the same as provided by law for like services in other cases. Said costs and expenses shall be paid, by the order of the court, out of the drainage fund provided for that purpose, and the board of drainage commissioners shall issue warrants therefor when funds shall be in the hands of the treasurer.

Pay of engineer.

Viewers other than engineer.

Rodmen and other laborers.

Fees and costs as prescribed by law.

SEC. 37. *Defects in proceedings.*

The provisions of this act shall be liberally construed to promote the leveeing, ditching, draining and reclamation of wet and overflowed lands. The collection of the assessment shall not be defeated, where the proper notices have been given, by reason of any defect in the proceedings occurring prior to the order of the court confirming the final report of the viewers; but such order or orders shall be conclusive and final that all prior proceedings were regular and according to law, unless they were appealed from. If on appeal the court shall deem it just and proper to release any person or to modify his assessment or liability, it shall in no manner affect the rights and legality of any person other than the appellant, and the failure to appeal from the order of the court within the time specified shall be a waiver of any illegality in the proceedings, and the remedies provided for in this act shall exclude all other remedies.

Act to be liberally construed.

Order confirming final report conclusive.

Modification on appeal to affect appellant only.

Failure to appeal a waiver.

SEC. 38. Proceedings under this act may be *ex parte* or adversary. Any engineer, viewer, superintendent of construction or other person appointed under this act may be removed by the court, upon petition, for corruption, negligence of duties or other good and satisfactory cause shown.

Proceedings ex parte.

Removal of officers or employees for cause.

SEC. 38½. This act shall not repeal or change any local drainage laws already enacted or to be enacted by the General Assembly of one thousand nine hundred and nine.

Local drainage laws not affected.

SEC. 39. All laws in conflict with this act are hereby repealed: *Provided*, that proceedings now pending by virtue of any statute now or heretofore in force in this State in any county shall not be affected by this act, but that such proceedings may be continued in accordance with such statute or in accordance with the provisions of this act.

Repealing clause.

Proviso: proceedings pending not affected.

SEC. 40. This act shall be in effect from and after its ratification.

Ratified this the 5th day of March, A. D. 1909.

NSTRUCTIONS AND SUGGESTIONS TO ENGINEERS AND VIEWERS, IN CONNECTION WITH THE ESTABLISHMENT OF DRAINAGE DISTRICTS IN NORTH CAROLINA.

By JOSEPH HYDE PRATT, State Geologist.

In order that the drainage work in North Carolina shall be carried on with ome degree of uniformity, the following instructions are recommended to the ngineers and viewers appointed by the clerk of the court to be followed in naking surveys and reports of public drainage districts. The authority auhorizing the organization of public drainage districts and the appointment of he engineer and viewers is conferred by the statute and must be strictly ollowed. They shall perform each and every duty that the law prescribes hey shall perform, and shall not do anything or make any report other than hat which is provided by the statute.

SUGGESTION TO CLERK OF COURT.

In the notice of appointment sent out by the clerk of the court notifying he engineer and viewers of their appointment, he should appoint a day when he engineer and viewers shall meet at his office and qualify for their duties. lthough the law does not especially require it, it might be well for the enineer and viewers to take an oath before the clerk to faithfully and honestly ischarge their duties without partiality or prejudice to any one and to the est of their knowledge and ability. The clerk should make an entry of this otice in the drainage record.

INSTRUCTIONS TO ENGINEER AND VIEWERS.

Preliminary Report.—The engineer and viewers should, as soon as possible fter their appointment, fix a time and place to meet to commence the examinaon of the lands embraced in the petition. They should gather sufficient data om a personal examination of the lands, from the study of maps and any rveys that have been made, and by making actual surveys if they deem it ecessary in order to reply directly to the four provisions, one, two, three, and ur, set out in section 3 of the drainage law. These should be answered iefly and directly to the point, as follows:

1. *(a)* The proposed drainage is practicable, or
(b) The proposed drainage is not practicable.
2. *(a)* The proposed drainage will benefit the public health, or
(b) The proposed drainage will not benefit the public health.
(c) The proposed drainage will benefit one or more public highways, or
(d) The proposed drainage will not benefit any public highway.
(e) The proposed drainage will be conducive to the general welfare of e community, or
(f) The proposed drainage will not be conducive to the general welfare the community.

3. *(a)* The proposed drainage will benefit the lands sought to be benefited,

(b) The proposed drainage will not benefit the lands sought to be benefite

4. *(a)* All the lands that are benefited are in the proposed district, or

(b) The following lands will not be benefited and should not be in th district, or

(c) The following lands not embraced in the district will be benefited a should be included.

(Here set out a list of the lands to be omitted or included.)

A map of the proposed district should be filed with the report. It shou be made to a scale and be reasonably accurate. It should show the bounda of the district, the location of ditches or levees or other improvements, natu streams, large sloughs and ponds, railroads, highways, and the relative ele tion of the several parts if ascertained. The land lines need not be shown this map and no attempt at embellishment should be made. The letters a figures should be neat, plain, and large enough to be easily read.

This report should be signed by the engineer and viewers and delivered one of them to the clerk of the court. The landowners in the district ne not be advised of the time when this report will be filed.

At the day fixed by the clerk of the court to hear and determine this repo the engineer and viewers may or may not attend as they see fit, though i best for one or more of them to be present to explain and defend the rep submitted by them. If the court approves the report, it is referred back the engineer and viewers for a complete report.

Complete Report.—In preparing a complete report the engineer and view shall:

I. Make a survey of each ditch or drain by giving its course and dista and by marking it on the ground by blazing trees and planting suitable sta and monuments. These may be placed at each 100-foot station or at beginning and terminus and the intermediate angles or at such other po as the engineer may determine. This marking is for the purpose of show the interested parties just where a ditch is located.

II. After the ditch is located, a line of levels must be run, giving the el tion at sufficient points to furnish an accurate profile of the surface. If old ditch or channel is used it must be accurately cross-sectioned and amount of excavation saved computed. Where old ditches have been excav and the material removed has been left on the bank and it has to be rehan in the construction of a new channel, no credit should be allowed.

III. If doubt exists as to the amount of fall or course of natural drai for the several parts of the district, such other levels may be run as needed to settle such points.

IV. A drainage map shall then be made on a suitable scale (about feet per inch), showing—

(a) Boundary of the district.

(b) Location of all proposed work.

(This might be shown in red or some other color.)

(c) Location of railroads and highways.

(d) Boundaries of towns and villages, if any.

(e) Land lines of the property within the district.

(f) Profile or general description for each ditch or other improvement.

(g) An itemized statement of the work to be done, with estimated cost of same.

(h) Total cost of the improvement.

This survey should be made by the engineer with or without the viewers. In doing this work advantage should be taken of work that has been done by the State or United States Government, and the cost should be kept as low as is consistent with good work.

V. If it is found necessary to go beyond the boundary of the district to secure a proper outlet or remove any obstruction from the stream, the engineer should show this in his report and make a survey and map showing what property would be required, so that the necessary procedure may be instituted to acquire it, either by purchase or condemnation.

VI. Any damage claimed by any one within the district (not for right of way outside of the district) must be determined by the engineer and viewers and included in their report.

VII. *Classification of Lands.*—This duty is the most difficult and the most important of any provided by the statute. It requires much judgment and discretion to perform it satisfactorily and should be given a most careful and painstaking consideration. It is solely a matter of judgment of land and land values and the increase in value that will result from the improvement. The following method of arriving at the proper classification of lands has been found satisfactory in other places and is here recommended as tending to assist the viewers to arrive at just and equitable conclusions:

On entering a tract of land the viewers should first consider it as to its degree of wetness or liability of losing a crop by being overflowed and drowned out. Each viewer should be provided with a pencil and tablet, and mark, without conference with the other viewers, his judgment as to the rating of this particular piece of land in regard to wetness on a scale of 100. Each viewer should then mark this same piece of land as to its proximity to the proposed ditch or other natural outlet, the tract lying adjacent to the ditch being marked 100 and the others correspondingly less as they are located farther away. Then the viewers should grade this same piece on a scale of 100 with reference to its fertility, the most fertile land being marked on a scale of 100 and all the other tracts correspondingly less as their fertility decreases. These three markings should be added and their sum divided by three. This will give the rating on these three points as determined by each of the viewers. If the results thus obtained by the three viewers vary materially, as they are likely to do, the matter should be discussed by them until they reach a result satisfactory to at least two of them. This rating when finally obtained will determine the class into which this tract of land should be placed.

If it is above 80 it should go in Class A;
If between 60 and 80, in Class B;
If between 40 and 60, in Class C;
If between 20 and 40, in Class D; and
If less than 20, in Class E.

The viewers should bear in mind that the point to be determined is not the whole amount of benefit that will accrue to a piece of land from the improvement, but the relative amount as compared with other lands in the same district.

VIII. When the lands are classified they should be arranged in tabulated form showing the number of acres owned by each person in each class and the total number of acres benefited in each class.

Caution.—The assessment roll or the amount of tax against each particular tract of land is not to be computed by the engineer and viewers. It has no part in their report, and by referring to section 31 of the drainage law it is clearly shown that this work is to be done by the drainage commissioners after the classification has been confirmed by the clerk of the court.

IX. Highways and railroads are not to be classified like agricultural lands, but must be examined by the engineer and viewers, and if in their judgment such highways or railroads will be benefited by the proposed improvement they should be assessed a fixed sum. In determining the amount of assessment against the public highway or railroad, only that portion of the roadbed in a district may be considered. The permanent betterment of the tangible property by the proposed improvement is the amount of benefits that the roadbed will receive. No rule can be laid down for determining this amount. It is solely a matter of judgment for the engineer and viewers. Unless the engineer and viewers are fully convinced that the highway or roadbed of the railroad will be benefited by the improvement, no assessment should be made against the property.

X. The engineer and viewers must keep an accurate account of the time employed and the expense incurred in the discharge of their duties as provided in section 13 of the drainage law. Some question has arisen as to how this compensation shall be paid. Section 2 of the drainage act provides that the drainage engineer and his assistants shall be paid by the Geological and Economic Survey, but since the Legislature failed to make any appropriation for such purpose there is no fund available and this cannot be done. Section 16 of the drainage law authorizes the clerk of the court to collect from the petitioners from time to time such amounts as may be necessary to pay cost accrued, other than that of the engineer and his assistants. Since the petitioners have a large pecuniary interest in the work, they should advance this preliminary expense. If the district is not established they are liable for this expense on their bond filed with the petition. If the district is established they can be repaid from the special assessment when it is levied and collected. It will be wise for the engineer to have an understanding with the clerk of the court and the petitioners before he accepts the appointment and enters upon his duties, as to what his compensation is to be and who is to advance it, if he is not willing to wait until the money is collected in the regular way. It is hoped that the next Legislature will appropriate a sum from which these preliminary expenses may be paid as provided in the law.

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, State Geologist

ECONOMIC PAPER No. 19

FOREST FIRES IN NORTH CAROLINA DURING 1909

BY

J. S. HOLMES, Forester

RALEIGH
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS
1910

557
N813e
19

GEOLOGICAL BOARD.

Governor W. W. Kitchin, *ex officio* Chairman	Raleigh.
Frank R. Hewitt	Asheville.
Hugh MacRae	Wilmington.
C. S. Vann	Edenton.
R. D. Caldwell	Lumberton.

Joseph Hyde Pratt, State Geologist	Chapel Hill.

LETTER OF TRANSMITTAL.

Chapel Hill, N. C., May 1, 1910.

To His Excellency, Honorable W. W. Kitchin,
Governor of North Carolina.

Sir:—I herewith submit for publication, as Economic Paper 19 of the reports of the North Carolina Geological and Economic Survey, a report on the Forest Fires in North Carolina during 1909, which has been prepared by Mr. J. S. Holmes, Forester to the Survey.

The statistics regarding the forest fires have been obtained largely by correspondence and in coöperation with the Forest Service of the U. S. Department of Agriculture.

Yours respectfully,

Joseph Hyde Pratt,
State Geologist.

TABLE OF CONTENTS.

PAGE.

List of Illustrations 5
Preface 6
Introduction 7
Forest Regions 9
    Mountain Region 10
    Piedmont Region 10
    Coastal Plain Region 11
Weather Conditions in 1909 11
Tabular Statement 12
    Summary of Replies from Correspondents, by Regions (Table 1) 12

    Forest Fires in the State of North Carolina, 1909:
        Mountain Region, Table 2 13
        Piedmont Region, Table 3 14
        Coastal Plain Region, Table 4 16
    Averages by Regions and State (Table 5) 18
    Analysis of Tables 18
        Number of Fires 18
        Area Burnt Over 19
        Standing Timber Destroyed 20
        Average Amount and Value of Standing Timber Destroyed per Acre Burned Over (Table 6) 21
        Forest Products Destroyed 22
        Improvements Destroyed 22
        Human Lives Lost 22
        Amount Spent in Fighting Fires 23
Loss from Fires that is Not Covered by Questions 24
    Timber Injured and Reduced in Value 24
    Injury to Young Growth and Reproduction 25
    Injury by Change in Composition of the Forest 26
    Impoverishment of the Soil 27
    Soil Erosion 28
    Injury to Streams 28
Causes of Forest Fires 29
    Causes of Fires by Forest Regions (Table 7) 29
    Unintentional Causes 30
        Farmers Burning Brush, etc. 30
        Hunters 31
        Campers 31
        Matches 32
        Railroads 33
        Lumbering 34
        Sawmills 34
    Intentional Fires 35
        Protection Fires 35
        "Improving" the Range 36

Causes of Forest Fires—*Continued.*

Intentional Fires:

PAGE.
Chestnut Gatherers 37
No Particular Reason 37
Malice 38
Unknown Causes 39
Prevention of Forest Fires 40
Public Opinion 40
Stock Law 41
Fire Laws 42
Railroads 42
Fire Protection 43
Fire Lines 43
Fire Patrol 44
Fire Notices 44
Extinguishing Fires 47
Conclusion 48

LIST OF ILLUSTRATIONS.

PLATE *Facing Page*
I. Our vanishing hardwood supply emphasizes the increasing necessity for fire protection. Virgin white oak, 200-300 years old, Buncombe County, N. C. Such large trees are rarely killed by the common surface fires.......... 7
II. The result of spring fires in the Coastal Plain region: *A*, A grove of longleaf pine 15-20 feet high burnt to the top and killed. *B*, Large oak trees just coming into leaf killed by surface fires.. 20
III. One result of burning the woods. Mature longleaf pine timber destroyed by fire getting into old boxes.......... 20
IV. How surface fires destroy mature timber. Base of pine tree burnt through by fire in the boxes. This will blow down, or be burnt down by the next fire.......... 22
V. The increasing necessity for fire protection. Our future hardwood supply, showing reproduction of white oak, Buncombe County, N. C. Surface fires would absolutely destroy or vitally injure these young trees.......... 24
VI. Two ways of treating a cut-over forest: *A*, Hardwood forest burnt over after logging, Watauga County, N. C. All reproduction and most of the second growth has been killed. *B*, Hardwood forest protected from fire. Thrifty yellow poplar reproduction, Buncombe County, N. C. A forest fire would destroy this growth.......... 26
VII. Longleaf pine forest. Seedlings of longleaf pine up to six years of age killed by surface fire.......... 26
VIII. *A*, Effects of boxing and fire. Pine forests laid waste in Coastal Plain region. *B*, Fire protection. Road used as a fire-break with complete success in a longleaf pine forest.......... 40
IX. Fighting fire with the plow. Surface fire in pine forest stopped by plowing two double furrows.......... 42

PREFACE.

On account of the enormous loss that North Carolina sustains each year as a result of forest fires, the North Carolina Geological and Economic Survey decided to make an investigation regarding the number of forest fires, the amount of damage resulting from them, their causes, and whether it would have been possible to have prevented any of them. The information has been obtained largely by correspondence and in coöperation with the Forest Service of the U. S. Department of Agriculture, which is collecting similar statistics from all over the country.

Although we were not able to obtain as full information as was desired, yet the statistics that have been collected are of considerable importance and show the need of some legislation to prevent as much as possible this enormous waste that is caused each year by forest fires.

It is hoped that this report will be the means of awakening our people to the realization that forest fires are causing a heavy loss to the State each year and that some legislative action is necessary to remedy this.

Joseph Hyde Pratt,
State Geologist.

Plate I. Our vanishing hardwood supply emphasizes the increasing necessity for fire protection. Virgin white oak, 200-300 years old, Buncombe County, N. C. Such large trees are rarely killed by the common surface fires.

FOREST FIRES IN NORTH CAROLINA DURING 1909.*

By J. S. HOLMES, Forester.

INTRODUCTION.

Fire is undoubtedly the greatest enemy to the forest. It is estimated by the National Conservation Commission, in its report recently published, that the direct loss in the United States caused by the destruction of standing timber by fire has averaged $50,000,000 a year for the past thirty years. This takes no account of the destruction of young growth and other injuries which the forest sustains from fire, which, if it could be estimated, would at least double this figure.

According to the census of 1880, 546,000 acres of forest land in North Carolina were burned over the previous year, involving a property loss alone of $357,000. This estimate was based on circular-letters of inquiry sent out to correspondents in all parts of the State, and not on a house-to-house canvass, as the other census figures usually are. Many counties were not heard from at all, and the information from others was discarded as being contradictory or of doubtful accuracy. For this reason these figures were in all probability much too low.

In 1894 an attempt was made by the North Carolina Geological Survey to collect data on forest fires and get an estimate of the annual damage done by them to the forests of the State. This, also, was done by correspondence, and many of the counties were not heard from at all. The results of this inquiry were published in Bulletin 7 of the North Carolina Geological Survey and were summarized by the author, Mr. W. W. Ashe, then in charge of Forest Investigation, as follows:

> The damage as stated by the correspondents from the several reporting counties must have aggregated over $400,000, and there must have been between 800,000 and 1,200,000 acres burned over during the year. It is difficult to fix any standard by which losses can be ascertained; for only mature trees of certain merchantable species are considered in making the estimates, while the destruction of kinds with no commercial valuation as yet, and young growth, is counted as nothing. The counties reporting embraced only about one-half of the area of the State, and the writer from his own observation of the damage wrought in previous years in these nonreporting counties would estimate the damage of them at over one-half of what it is in the other counties, or over $200,000. The entire loss in 1894 caused by forest fires in the State was certainly not less than $600,000; and from 1,500,000 to 2,000,000 acres of forest and waste lands were burned over.

---

*The statistics used in this report have been collected by the United States Forest Service in co-operation with the North Carolina Geological and Economic Survey.

One of the greatest obstacles which we have to encounter in our fight for the control and prevention of forest fires is the lack of reliable statistics on this question. Most people have a vague sort of idea that serious fires, which do not occur very often, do considerable damage, and that light grass or leaf fires, though they are very common, do little or no damage—in fact, are hardly of enough importance to be classified as forest fires. This can be gathered very readily from the replies of many of our correspondents. But when it comes to estimating the annual damage caused by forest fires in the State or in any one county or township, or even telling what was the actual damage caused by any one fire, even the most intelligent and wide-awake citizens seem unable to do it.

The estimated damage done to our forests by fire fifteen or thirty years ago carries little weight with the average man when used as an argument for present and immediate action. What is wanted to impress the people with the importance of this subject and the crying need for a united effort to curtail this enormous annual waste are figures as up to date and as accurate as it is possible to procure.

In the fall and winter of 1908, an attempt was made by the Forest Service of the United States Department of Agriculture to procure figures as to the extent and seriousness of forest fires in every State in the Union for the use of the National Conservation Commission. For many of the States, North Carolina among the number, it was found that no figures were available, so that, in compiling the fire damage for the whole country, often the roughest estimates had to be used.

In the summer of 1909, the Forest Service asked the coöperation of the North Carolina Geological and Economic Survey in the collection of forest-fire statistics for that year in this State. The Survey was not only willing, but anxious, to procure these figures, so was very glad to coöperate with the Federal Government in this work. A circular-letter was sent out to six or eight of the leading men in every county of the State, telling them that at the end of the year a blank form would be sent them with a request to answer certain questions relating to forest fires, and asking them in the meantime to institute inquiries and make notes on any fires that might come to their notice. Early in December the blank form was sent to these correspondents, accompanied by a letter asking them to give as accurate information as possible, and, where accurate information could not be obtained, to make a careful estimate of the injury done by forest fires in their county or township.

In order that the results obtained may be better understood, the form as sent to these correspondents is here given:

FOREST FIRES IN THE STATE OF NORTH CAROLINA, 1909.

1. To what county (or township) do the statistics given below apply?.......
....
2. How many different forest fires have you had during the year 1909?.......
....
3. What was the total acreage burned over in your county during the past year?...
   a. Number of acres of forest land growing merchantable timber?..........
   ....
   b. Number of acres in second growth that was not yet merchantable?......
   ....
   c. Number of acres of cut-over land?..................................
4. How much merchantable standing timber has been destroyed by fire? Give amount in board feet ....
5. What was the approximate value of this timber as it stood? ....
6. What is the value of all forest products, such as sawlogs, lumber, ties, etc., that were destroyed? ....
7. What is the value of all improvements, such as fences, barns, houses, mills, etc., and of live stock that was destroyed? ....
8. Have any human lives been lost? If so, how many? ....
9. State as close as possible what it has cost private individuals, lumber companies, and others to fight forest fires in your county ....
10. What were the causes of the forest fires? ....

Out of upwards of 600 persons all over the State to whom these questions were sent, scarcely more than 150 sent in replies of any kind, even though a second call was made to counties not reporting at first. Many of the replies were incomplete, the correspondents answering only part of the questions. The data submitted, however, though meager and insufficient, have been tabulated according to counties and regions. In many cases the figures given refer to only one or two townships in a county; but, for lack of more complete information, these have been used in nearly every instance just as received. It must be borne in mind that, on an average, less than two reports have been received from each county for which figures are given, and that only four counties were reported on by more than three persons.

The actual figures are published here, not so much to give an accurate estimate of the amount of damage done by forest fires in 1909 as for the purpose of calling the attention of the people of North Carolina to this great waste that is going on all the time, so that they can use what means they have in their power to stop it.

FOREST REGIONS.

In order that a better understanding of the figures may be had and that more intelligent deductions may be drawn from the tables presented, a brief description of the forest regions of the State is here given.

Mountain Region.—This includes all the counties west of the Blue Ridge. The country is, on the whole, rugged and broken with high mountains, steep slopes and usually narrow valleys. In spite of this, however, about one-fourth of the area has been cleared for cultivation. The forests, which almost exclusively occupy absolute forest land, are of two formations. The *spruce* formation, of which there is only a comparatively small area, occupies the tops and upper slopes of many of the higher mountains. These spruce forests in their virgin condition, catching as they do much rainfall that would not be precipitated on the lower altitudes, are usually so moist that they are little subject to forest fires. When, however, they are cut over, as some of them have been during the last few years, for pulp and lumber, the surface soil dries out and the laps and tops become very inflammable. Where fires burn over these slashings, not only is the young growth and reproduction all destroyed, but even the soil, which is chiefly vegetable mold, is burnt up, so that the area is reduced to a barren waste, and there is little chance of its further usefulness, either as a producer of timber or, which are its much more important functions, as a preventer of erosion and a regulator of stream flow. Fire should be kept out of this type at all costs, as burning it is most disastrous. Much the greater part of the forest, however, in this region consists of the *hardwood* formation, chestnut and the oaks being the chief trees. There will be found occasional mixtures of the pines and hemlock, and even some small areas of pure forests of these species on grown-up old fields or cold north slopes, but these are not permanent enough or distinct enough to be separated as definite types. Forest fires in these hardwoods are usually surface or leaf fires, though occasionally on the higher mountains, where decomposition of the leaf mould takes place slowly, a fire in a dry time will consume all the humus and much of the surface soil. Though these fires usually only kill mature timber when they come late in the spring, after the sap has started to rise, still every fire does very great damage to the old timber, to reproduction, and to the soil, all of which is hard to calculate in dollars and cents.

Piedmont Region.—The forests of the Piedmont Plateau are usually hardwood, with the oak predominating, or mixed hardwood and pine. In the western part of the region they occupy the steeper mountain slopes, often in large continuous areas. Farther east, however, where the larger part of the land is cleared for agriculture, the forest areas are chiefly woodlots belonging to the different farms, and occupying land that is not wanted for cultivation, or in many cases is too rough for profitable farming. Here fires become scarcer because these small areas are more easily protected and controlled by their owners, and because, the stock being kept up, there is less inducement to burn the woods for the range.

Coastal Plain.—This forest region occupies a belt averaging about 100 miles wide, along and parallel to the coast, and corresponding with the "coastal plain" geological formation. This area was originally covered by a pure forest of longleaf pine, with hardwood swamps along the water-courses. The pinelands have practically all been cut over, though on some of them a second growth of loblolly pine, much of which is now merchantable, has taken its place. Through these broken pine stands and the very open cut-over lands, wild grasses flourish. It is these grasses, after being dried out by the frost, together with the fallen pine leaves, which feed the frequent, almost annual, fires. These fires, though seldom seriously injuring mature, round timber, are a great menace to boxed timber, and also go far toward preventing any kind of pine reproduction.

The swamp areas in this region are usually too wet to burn, but during occasional very dry seasons they will catch fire and not only the accumulation of leaves, grass, and brush will burn, killing the young growth and reproduction, but in the drier parts the soil burns, and causes the destruction of considerable timber by undermining the roots.

WEATHER CONDITIONS IN 1909.

The weather conditions have much to do with the frequency and destructiveness of forest fires. In considering this subject it is well, therefore, to keep in mind the prominent features of the weather, more especially of rainfall, during the year under discussion.

According to the annual report of the North Carolina Section of the Weather Bureau, the average precipitation for the State in 1909 was 47.78 inches, which was 10 inches less than during the preceding year and 3 inches below normal, which is the average of all the years for which the records have been kept. The first three months of the year were drier than usual over the greater part of the State, the rainfall for this period being considerably below normal. In the mountains the precipitation was about normal through February and March, but during April this part of the State was rather dry. In May the rainfall was 1 inch below the normal in the eastern district, above normal in the central, and 3 inches above normal in the western district. June was the wettest on record, the average rainfall for the month being 7.92 inches, and going as high as 17.05 inches at one station near the coast. During July and August the precipitation was about normal all over the State. In September a droughty condition commenced in the eastern and central districts, which lasted up till the middle of December. During this season there were no general rains over the eastern and central districts. This did not seriously affect the mountain counties, though November was exceptionally dry all over the State.

This long dry fall made a season exceptionally conducive to forest fires. In a year of normally distributed rainfall it is probable that the injury from fires might be considerably less.

TABULAR STATEMENT.

That the general distribution over the State of the damage from forest fires may be better realized, and in order to furnish a basis of comparison for future reports, the following tables are given. It must, however, be remembered that the figures are not actual areas and losses, but are in most cases but rough estimates made by correspondents in the different parts of the State and are probably in most cases too low.

Table 1.—Summary of Replies from Correspondents, by Regions.

	Mountain Region.	Piedmont Region.	Coastal Plain Region.	State.
1. Total number of replies	47	61	50	158
2. Total number of fires reported	249	86	272	607
3. Total area burnt, in acres	166,295	100,670	139,100	406,065
3*a*. Total area burnt of growing, merchantable timber, in acres	128,145	77,735	51,025	256,905
3*b*. Total area burnt of second growth, not yet merchantable, in acres	13,100	14,555	27,050	54,705
3*c*. Total area burnt of cut-over land, in acres	25,050	8,380	61,025	94,405
4. Total standing timber destroyed in M bd. ft.	17,325	11,027	9,280	37,632
5. Value of timber destroyed, in dollars	$ 47,520	$ 33,374	$ 26,360	$107,254
6. Value of products destroyed, in dollars	$ 17,075	$ 39,425	$ 30,245	$ 86,745
7. Value of improvements destroyed, in dollars	$ 26,550	$ 14,750	$ 17,105	$ 58,405
9.* Total cost to fight fires, in dollars	$ 6,650	$ 1,059	$ 6,355	$ 14,064

*The answers to Question 8 (Have any human lives been lost? If so, how many?) have been omitted from these tables because no lives were reported lost from forest fires in this State during 1909.

Table 2.—Forest Fires in the State of North Carolina, 1909. Summary of Reports from Correspondents, by Counties.

MOUNTAIN REGION.

County.	Number of Replies.	Number of Fires.	Total Area Burnt—Acres.	Total Merchantable Timber Burnt—Acres.	Total Second Growth Burnt—Acres.	Total Cut-over Land Burnt—Acres.	Merchantable Timber Destroyed in M Bd. Feet.	Value of Timber Destroyed.	Value of Products Destroyed.	Value Improvements Destroyed.	Cost to Fight Fires.
Alleghany	2	2	100	100			5	$ 10	$ 200	$	$
Ashe	1	1	200	200			10	40	1,000	500	100
Buncombe	6	15	7,100	4,100	2,300	700	2,500	6,000	500	7,250	2,000
Cherokee	3	20	30,000	20,000	5,000	5,000	5,000	15,000		500	400
Clay	3	100	15,000	10,000		5,000	1,000	1,000	5,000	6,000	2,000
Graham	3	10	50,000	50,000			100	100	500	600	
Haywood	3	5	10,000	9,000		1,000	200	800	2,000	1,000	500
Henderson	5	15	8,320	4,270	800	3,250	600	600		100	75
Jackson	3	15	2,000	2,000			2,000	6,000			75
Macon	1	1	10,000	5,000		5,000	10	20			
Madison	1										
Mitchell	3	4	1,000	1,000							100
Swain	5	50	30,000	20,000	5,000	5,000	5,500	17,500	7,500	10,000	1,250
Transylvania	2	5	2,075	2,075			100	200		100	
Watauga	5	6	500	400		100	300	250	375	500	150
Yancey	1										
Total	47	249	166,295	128,145	13,100	25,050	17,325	47,520	17,075	26,550	6,650

TABLE 3.—FOREST FIRES IN THE STATE OF NORTH CAROLINA, 1909. SUMMARY OF REPORTS FROM CORRESPONDENTS, BY COUNTIES.

PIEDMONT REGION.

COUNTY.	Number of Replies.	Number of Fires.	Total Area Burnt—Acres.	Total Merchantable Timber Burnt—Acres.	Total Second Growth Burnt—Acres.	Total Cut-over Land Burnt—Acres.	Merchantable Timber Destroyed in M Bd. Feet.	Value of Timber Destroyed.	Value of Products Destroyed.	Value Improvements Destroyed.	Cost to Fight Fires.
Alamance	3	6	200	75	75	50		$ 500	$ 700	$ 1,000	$
Alexander	3	2	1,000	500	500						20
Anson											
Burke	3	15	70,000	65,000		5,000	15,000	2,250	20,000	7,000	200
Cabarrus	1	1	20	10	10						5
Caldwell	1	4	700	300	250	150	75	300	400	200	100
Caswell	1										
Catawba	1	3	150	50	70	30	300	750	400	100	
Chatham	1										
Cleveland	2										
Davidson	1	1	150	100	50		150	600	800	200	50
Davie	3	3	300	100		200				500	
Durham											
Forsyth	3										
Franklin	1										
Gaston	2										
Granville	1	3	100	50	50						
Guilford	2										
Iredell	1	4	1,000	500	500		3,000	15,000	2,000	5,000	12
Lee											
Lincoln											
McDowell	1	4	5,000	2,000	3,000		5,000	10,000	10,000		50
Mecklenburg	1										
Montgomery	2	6	15,300	3,500	10,000	1,800	10	25	500	500	312
Moore	1	8	1,000	500		500	102	884	1,125		
Orange	2	1	300	300							60
Person	2	1	50	10	40						
Polk	2	6	4,500	4,000		500	200	400	500	200	100

Randolph	1										
Rockingham	3	1	500	500			10	20	1,500		
Rowan	1										
Rutherford	1	2									
Stanly	1	2	100	100			5	20			
Stokes	1										
Surry	1	6	100	100			600	2,400			100
Union	2	2									
Vance	2										
Wake	1										
Warren	2										
Wilkes	2										
Yadkin	2	5	200	40	10	150	75	225	1,500		50
Total	61	86	100,670	77,735	14,555	8,350	11,027	33,374	39,425	14,750	1,059

TABLE 4.—FOREST FIRES IN THE STATE OF NORTH CAROLINA, 1909. SUMMARY OF REPLIES FROM CORRESPONDENTS, BY COUNTIES.

COASTAL PLAIN REGION.

COUNTY.	Number of Replies.	Number of Fires.	Total Area Burnt—Acres.	Total Merchantable Timber Burnt—Acres.	Total Second Growth Burnt—Acres.	Total Cut-over Land Burnt—Acres.	Merchantable Timber Destroyed in M Bd. Feet.	Value of Timber Destroyed.	Value of Products Destroyed.	Value Improvements Destroyed.	Cost to Fight Fires.
Beaufort	3	5	3,000	3,000				$ 2,000	$	$ 1,000	$
Bertie	2	4	1,000	800		200	10	30	1,000	500	100
Bladen	3	4	6,000	5,800		200	4,000	6,000	100	1,000	200
Brunswick											
Camden											
Carteret											
Chowan											
Columbus	1	6	500	400	100		20	30	45	5	5
Craven	1	20	10,000	2,000	2,000	6,000					500
Cumberland	1	3	100	50	25	25	50	250			50
Currituck	2										
Dare	1										
Duplin											
Edgecombe	1	4	50	50							
Gates	1	12	2,000	1,000	500	500	150	500	1,200	200	200
Greene											
Halifax											
Harnett	1	5	10,000	2,000	2,000	6,000	1,000	1,000	2,000		
Hertford	1	9	3,700	2,000	1,700		500	4,000	5,000	6,000	1,000
Hyde	3										
Johnston											
Jones	1	2	20,000	5,000	5,000	10,000	500	1,000	15,000	2,000	2,000
Lenoir	1	12	1,000	500	500						
Martin	1	6	7,000	3,500	1,000	2,500			5,000	500	
Nash	1	15	1,500	1,000	500						
New Hanover											
Northampton	2	6	250	175	25	50	100	200		100	25
Onslow	1	5	15,000	8,000	5,000	2,000					

Pamlico	1	50	8,000	3,000		5,000	100	400	50	1,000	
Pasquotank	2										
Pender	1	50	20,000	7,000	6,000	7,000	300	600	400	3,000	500
Perquimans	2										
Pitt	1	4	5,000	2,000	2,000	1,000				1,000	500
Richmond	2	10	20,000	2,000		18,000	1,000	4,000		150	
Robeson	3	24	1,500	800	400	300	50	100	100		
Sampson	1										
Scotland	1	5									
Tyrrell	3	10	1,000	750		250	500	1,250	350	500	1,250
Washington	3	1	2,500	200	300	2,000	1,000	5,000		150	25
Wayne	2										
Wilson											
Total	50	272	139,100	51,025	27,050	61,025	9,280	26,360	30,245	17,105	6,355

TABLE 5.—AVERAGES BY REGIONS AND STATE (DEDUCED FROM TABLE 1).

	Mountain Region.	Piedmont Region.	Coastal Plain Region.	State.
Total number of counties in State and region	16	41	41	98
Number of counties not reporting		4	10	14
Number of counties reporting no fire	2	15	7	24
Number of counties reporting fires	14	22	24	60
Average number of fires per county reporting	15	2	9	7
Average area burnt per county reporting, in acres	10,393	2,721	4,810	4,803
Average damage per county reporting, in dollars	$ 6,112	$ 2,397	$ 2,562	$ 3,177
Average area of each fire, in acres	668	1,171	511	667
Average damage by each fire, in dollars	$ 393	$ 1,030	$ 294	$ 439
Average damage per acre, in cents	.59	.88	.57	.66

It can be readily understood that the figures given in these tables in almost all cases considerably understate the actual facts. This is so, partly because there is a tendency to underestimate damage that does not directly affect oneself, and partly because the observations of most people do not as a rule cover more than the immediate neighborhood in which they live, and in many cases the correspondents have only attempted to report for one township. This is also due to a considerable extent to the fact, elsewhere commented on, that many people do not seem to classify as forest fires ordinary grass or leaf fires that are set with some particular object in view.

ANALYSIS OF TABLES.

NUMBER OF FIRES.

From the tables it will be seen that over 600 forest fires were reported for the State, or an average of about seven fires per county reporting. That this does not adequately represent the actual number of fires which occurred can be judged from the fact that even in those counties best represented by correspondents, only a small part of the county was covered by the report. In Buncombe County, for example, the county reported on by the largest number of correspondents, who listed twice the average number of fires for the State, less than one-third of the townships were reported on. The adjoining county of Henderson also reported twice the average number of fires, yet only half the townships were reported on by a number of correspondents, second only to Buncombe. It is obvious, then, that in the middle and eastern parts of the State, where only one or two and at the most three correspondents were heard from in a county, the territory must have been even more inadequately covered.

Attention is called to the contrast between the number of fires per county reported for the Piedmont region and for the regions to the east and west of it. The actual difference is probably not so great as is indicated, but these figures give a fairly correct idea of the difference in conditions, due chiefly to the closed range in the Piedmont region.

AREA BURNT OVER.

From the tables it appears that a much larger area was burnt over in the mountain counties than in either of the regions to the eastward. Over 166,000 acres were reported burnt over, which is approximately 5 per cent of the total forest area of the region. While this is in all probability too low, it is much nearer the actual figure than is that for the Coastal region. In the eastern part of the State the replies represented such a comparatively few of the townships that the results are far from satisfactory. There was unfortunately much less interest manifested in the forest-fire question in this part of the State than in the hardwood region, though to the pine forests it is, if possible, of even greater importance.

The reason that the proportion of land growing merchantable timber which was burnt over was so much greater in the mountain counties is that so little of the forest area of this region is really destitute of timber that is salable in some form. The usual method of cutting in this region is to select the timber that will bring the best price at the time, and leave the rest for a future cutting. Usually, only forests logged by some large lumber company, where practically everything is taken, can be really classified as cut-over land.

Again, practically all hardwood forests contain some second growth, for very few of them are actually virgin, and it is often very difficult to determine to which of the classes named in the list of questions a given piece of woods belongs. Definitions of these three classes of forests, as applied to the hardwoods, are here given, though it must be remembered that no hard and fast rule can be made that can be applied to every case.

Forest growing merchantable timber is that forest which contains a sufficient amount of merchantable timber to justify a sawmill man or other operator going onto that land and conducting a profitable logging or other operation on the tract. "Merchantable" timber is timber that can *profitably* be turned into lumber, staves, ties, or other salable forest products.

Cut-over forest, for the purpose of this study, can be defined as that forest which has had so much of the merchantable timber cut from it that it will not pay a sawmill man or other operator to log the land, because what merchantable timber has been left is too scattered or of too small a quantity to make it profitable.

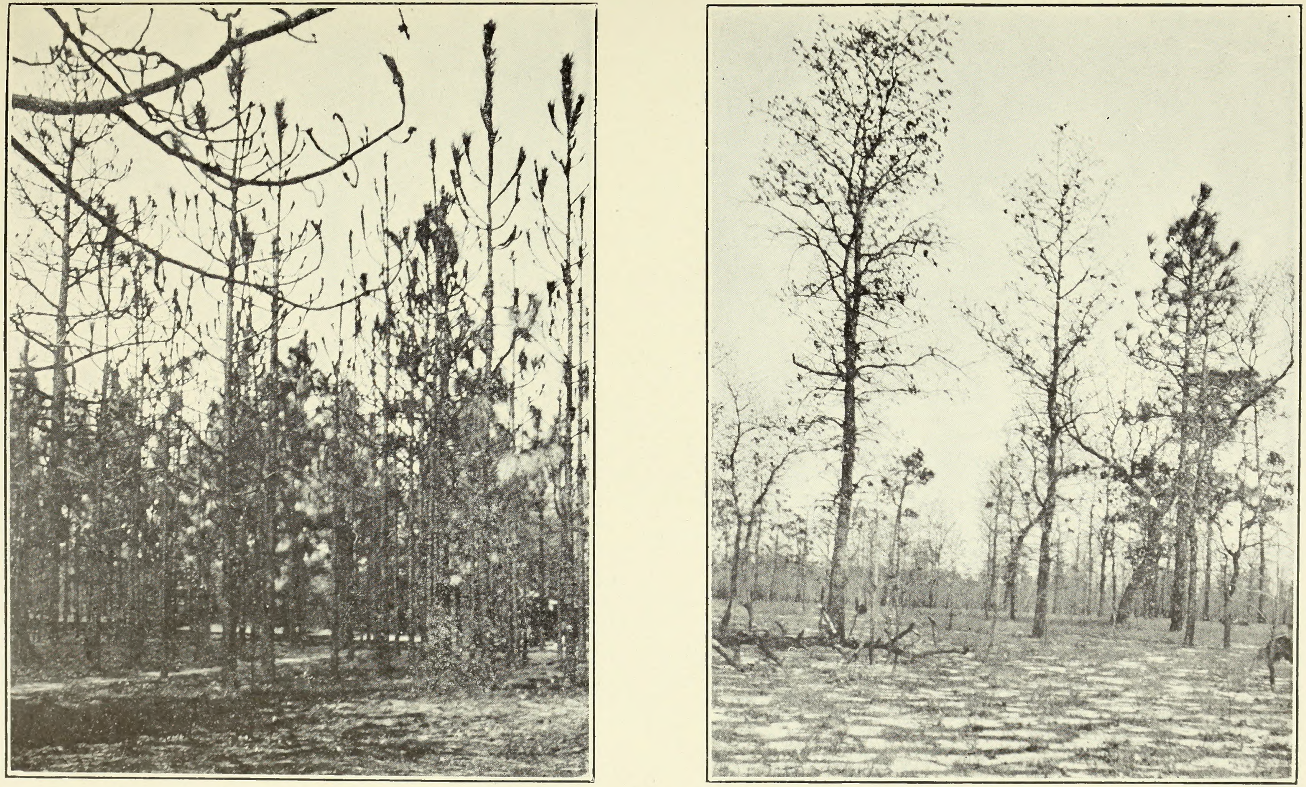
Cut-over land should, however, be classified as a *second-growth forest* if it supports 50 per cent or larger part of a full stand of second growth, namely, young trees of those species which when mature will be merchantable. If left to itself and fire is kept out, cut-over land will, at least in the hardwood type, rapidly become second growth; but, if repeatedly burnt over so that only worthless species, such as sassafras, sumach, sourwood, and black gum come up, it will in all probability remain cut-over land. Again, an old field grown up to half or more than half a full stand of pine or hardwood would be classified as a second-growth forest, though with much less density than that it would probably still be called old field. Young growth would not be called second growth until at least enough of it to form half a stand is as large as 4 inches in diameter.

This difficulty of classification is not so marked in the pine region. The present methods of lumbering generally remove all the merchantable timber in one operation, so that there is a pretty clear and sharp distinction between merchantable forest and cut-over land. On much of the cut-over pine land second growth has come in, and in such cases the distinction between the two must be more or less arbitrary, as suggested above.

STANDING TIMBER DESTROYED.

Where the woods are burnt annually during the winter, mature standing timber is seldom absolutely destroyed by forest fires, and this is the strongest argument in favor of the practice of burning. The disadvantages of burning, however, as discussed on another page, so far outweigh this one advantage that the owners of forest lands should be most reluctant to resort to it. If, on the other hand, a fire gets out in the spring, after the sap starts to rise and the buds on the trees are swelling or opening, the mature timber is very likely to be killed. This is especially true of the hardwood forests, where most of the timber destroyed is killed in this way.

In the Coastal region, also, much standing timber is killed by late spring fires, but there are two other important ways in which pine timber is destroyed by fire. Where fire gets out in a turpentine orchard that is being worked, or in one worked out that has not been lumbered, great destruction results. The fire gets into the boxes and eats into the base of the tree, and the tree is either killed or burnt down at once, or is so weakened that it is later blown down. Probably more longleaf pine timber has in the past been destroyed in this way than has been cut by the lumberman. And though, in present practice, lumbering usually quickly follows turpentining, still much timber is even yet destroyed by this means every year. The old method of turpentining is being super-



A.

B.

PLATE II. THE RESULT OF SPRING FIRES IN THE COASTAL PLAIN REGION: *A*, A GROVE OF LONGLEAF PINE 15-20 FEET HIGH, BURNT TO THE TOP AND KILLED. *B*, LARGE OAK TREES JUST COMING INTO LEAF, KILLED BY SURFACE FIRE.

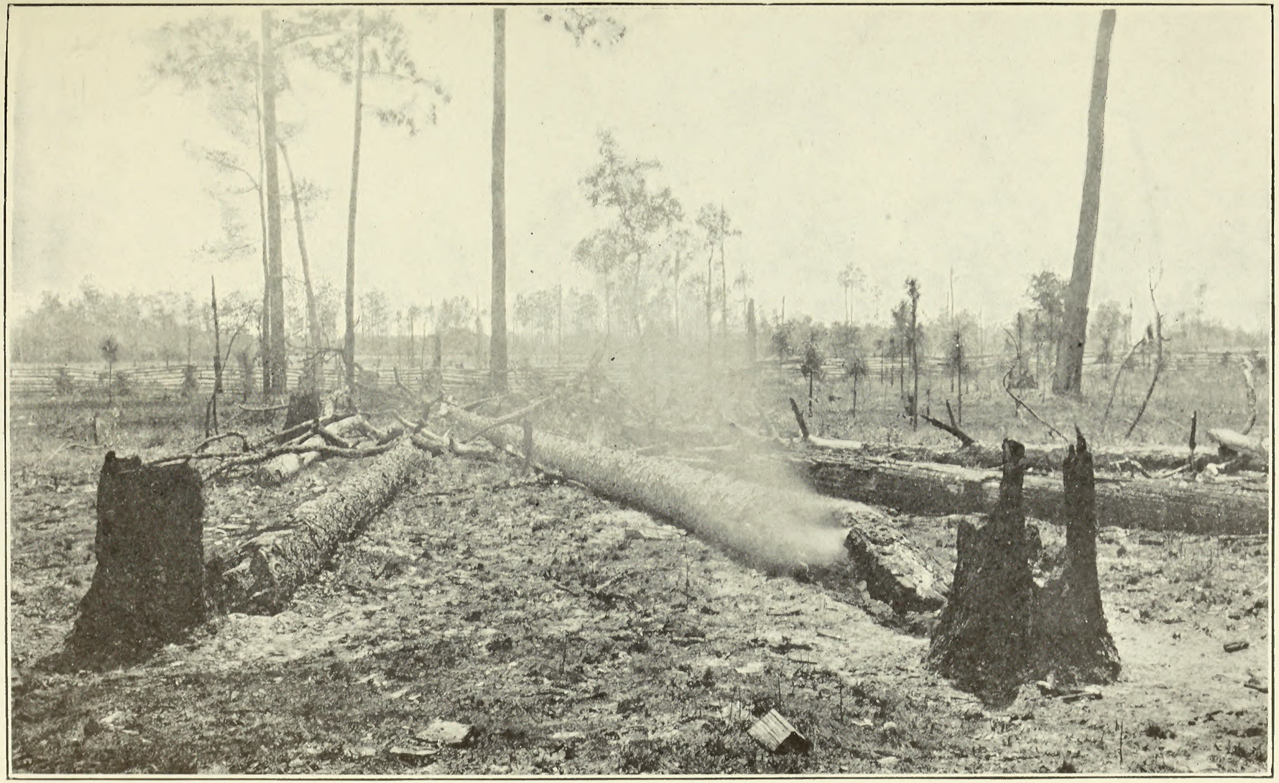


Plate III. One result of burning the woods. Mature longleaf pine timber destroyed by fire getting into old boxes.

seded by the modern cup-and-gutter system in most large operations, especially in the States to the south of us, and where this is used the fire risk is thereby greatly reduced. There is no reason why the small operator in our own State who works only a few hundred trees as a side issue should not take advantage of this most valuable improvement.

In exceptionally dry seasons, such as the past fall, many swamps and lowgrounds get dry enough to burn readily. Even the soil, which in such places is largely composed of vegetable matter, will at such times catch fire and burn for days. In this way a great many trees are thrown, by having the ground burnt from under them, and, though the trees themselves may not be burnt up, they will soon be destroyed by insects and fungus diseases. The loss, however, to the soil by burning these lowlands is often greater even than that to the timber.

Though undoubtedly far below the actual figures, the estimates in the previous tables of the amount and value of standing timber destroyed probably come nearer to the actual facts than those given for area burned over. The most destructive fires are the ones that are most likely to be reported, and the sometimes rather exaggerated estimate of injury done, when a man is reporting on his own loss, may partly, at least, compensate for the large number of fires that are not reported at all. It will, therefore, be interesting to compare these figures for the different regions of the State.

The following table (6) is based on the figures given previously in Table 1:

TABLE 6.—AVERAGE AMOUNT AND VALUE OF STANDING TIMBER DESTROYED PER ACRE BURNT OVER.

	Amount of Timber Destroyed (in Feet Board Measure) per Acre of Land Containing Merchantable Timber.	Amount of Timber Destroyed (in Feet Board Measure) per Acre Burnt Over.	Average Stumpage Value (in Cents) of Standing Timber Destroyed, per Acre Burnt Over.
Mountain region	134	104	29
Piedmont region	142	110	33
Coastal region	182	67	19
State	146	93	26

One of the most noticeable things which this table brings out is the comparatively little variation for the different regions of the State. The amount of timber destroyed per acre and the average value of it are almost identical in the two hardwood regions, being slightly greater in the Piedmont region, which might be expected, owing to the rarer occurrence of fires. In the Coastal region the amount of timber destroyed per acre of merchantable timber land burned over is somewhat greater, though compared to the total area burned over it is considerably less. This difference is due chiefly to the larger proportion of cut-over land in the burned area of this region.

FOREST PRODUCTS DESTROYED.

One very serious loss resulting from forest fires is the destruction of various forest products, either manufactured or in the process of making, but not yet hauled from the woods. Sawlogs cut and yarded; lumber yarded, but not disposed of; ties, staves, and shingles made and stacked up in the woods to season or to await a favorable time for hauling; cordwood for fuel, pulp, or extract wood waiting for an improvement in the market or the roads; tanbark, poles, posts, and various other products of the forests of the State, on which much labor has been expended, are destroyed every year in large quantities by forest fires. This loss, with ordinary care and foresight, should be prevented.

From Table 1 it is seen that about $85,000 was lost in this way in 1909; that is, every forest fire reported destroyed on an average $140 worth of such products.

IMPROVEMENTS DESTROYED.

Probably the most common and widely distributed direct loss from forest fires, outside of that from standing timber, is in the destruction of fences. Fifty-six thousand dollars was lost in 1909 by the burning of improvements, the greater part of which were probably fences. Some sheds, barns, and other outbuildings and even a house or two were burnt. Practically all this loss was due to carelessness in setting out and handling fires, and might and should have been prevented.

HUMAN LIVES LOST.

In the coniferous forests of many of the northwestern States forest fires sometimes rage so furiously that not only is the property loss enormous, but there is occasionally serious loss of human life. From one fire in Michigan in 1908 seventeen deaths were known to have resulted, and several more persons were badly injured. In that State alone during the fire season of 1908 not less than thirty-five people lost their lives as a direct result of forest fires.

Such fires could not occur in North Carolina, or only under very exceptional circumstances, because forest fires hardly ever burn through the tops of the trees, as they do in the spruce and pine forests of the

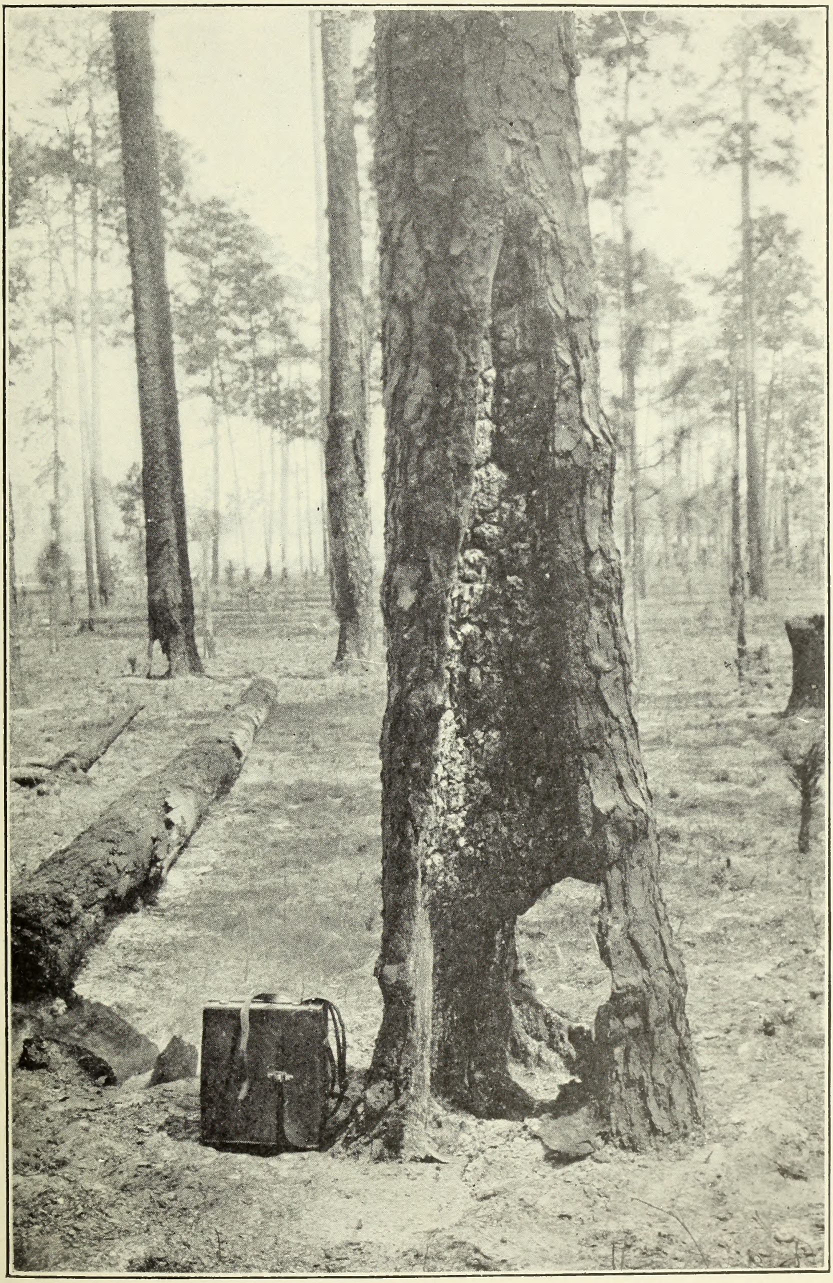


Plate IV. How surface fires destroy mature timber. Base of pine tree burnt through by fire in the boxes. This will blow down, or be burnt down by the next fire.

North. We are not, however, entirely free from this loss, for though no fatality, due to this cause, was reported for the year 1909, one death, caused by a forest fire, did occur in 1908. This was in one of the western Piedmont counties, where the forests are practically all hardwood.

Since these figures were compiled, news has been received of the sad death of a woman during the last days of March, 1910, in Cumberland County, who was killed while fighting a forest fire. Is it not time for the State and the people to get together and take some action toward checking this careless and wilful destruction of life and property?

AMOUNT SPENT IN FIGHTING FIRES.

By comparing the figures given under this heading in Table 1, it will be seen that only a small amount was estimated as spent for this purpose in the Piedmont region. It would appear that this is not entirely due to the smaller number of fires in this region, but partly to the method of estimating this cost. It is probable that most of the correspondents did not include the time of the farmer taken in fighting fires on his own land, but only counted such labor as was paid in cash by lumber companies or other large owners for this work. The figures given under the Mountain and Coastal regions tend to confirm this impression. In these regions about six times as much was spent for fighting fire as in the Piedmont section, probably chiefly because all the large forest holdings of lumber companies and others are in these two opposite sections of the State. Many of these companies pay out each year considerable sums to protect their properties from fire. But to obtain the true cost of fighting fires, there should also be added the time of the farmer who owns the small tract and of his family and neighbors spent in extinguishing fires and often in watching them, on and off, for days after the fire is under control. This often has to be done during the busiest season, when a man's time is worth two or three times what an extra man could be hired for at another time of the year. If this were included, the total cost would a long way exceed the $13,564 given in the table.

But the cost of fighting fire should also be looked at from another point of view. It really is in many cases money spent to protect the unburned woods from the fire, and this should be its object in many more cases. Too often protection only goes as far as keeping the fire from fences, barns, piles of lumber, etc., without attempting to keep it from burning through the woods, when really the few dollars worth of fence that might be destroyed would not compare with the damage done by allowing fire to burn through the timber and young growth. Viewed in this light, the eleven million acres of forest land in North Carolina cost a little over one-tenth of a cent per acre for protection in 1909. About 5 per cent of these forests were burned over, with a total loss of $245,000, or about 62 cents per acre burnt, or over 3 cents per acre for the total forest area of the State. If more had been spent in fighting fires, there is no doubt that the total loss would have been very much less.

LOSS FROM FIRES THAT IS NOT COVERED BY QUESTIONS.

So far only direct losses have been considered, such losses as could be readily assessed by any average jury almost as soon as the fire was over. There is, however, another class of damages, none the less serious because they show themselves gradually, and can, as a rule, only be fully estimated by an expert familiar with the growth and habits of trees in the forest. These damages, though not at once apparent, are readily seen by any woodsman when pointed out to him.

TIMBER INJURED AND REDUCED IN VALUE.

In the great majority of instances, where fire burns through woods containing merchantable timber, comparatively little of this is killed or destroyed outright. For this reason it is frequently claimed that surface fires do not injure the merchantable trees. But every fire leaves its mark on these trees. A bunch of leaves gathering on the upper side of a tree, or a log or limb falling beside one, makes a dangerous point of attack, where the fire will be hotter than the delicate inner bark can stand. Wounds made by such burns form points of attack for insects and disease germs, where they may enter and gradually spread, often through the whole tree. Some species are much more easily injured by fire than others. It has been estimated that 75 per cent of the standing chestnut in the mountains of this State is unfitted for a good grade of lumber by worms and rot, and this diseased condition of the chestnut has been largely brought about by fires. With an estimated stand of something like three billion feet of chestnut in the mountain counties of the State, 75 per cent of which is reduced $1 per thousand in value, which is a very moderate estimate, a total loss of $2,250,000 has resulted to forest owners through injury to this one species alone. It may be contended that this damage has been accumulating for a long time, but should it be spread out over the last one hundred years, which is certainly much longer than is necessary to get this result, we get an annual damage to chestnut alone of $22,500, which is practically half of the total value of timber destroyed outright by fire in that region in 1909. If the injury to the other timber, oak, poplar, hemlock, hickory, etc., which constitutes two-thirds of the stand in that region, be counted, it is

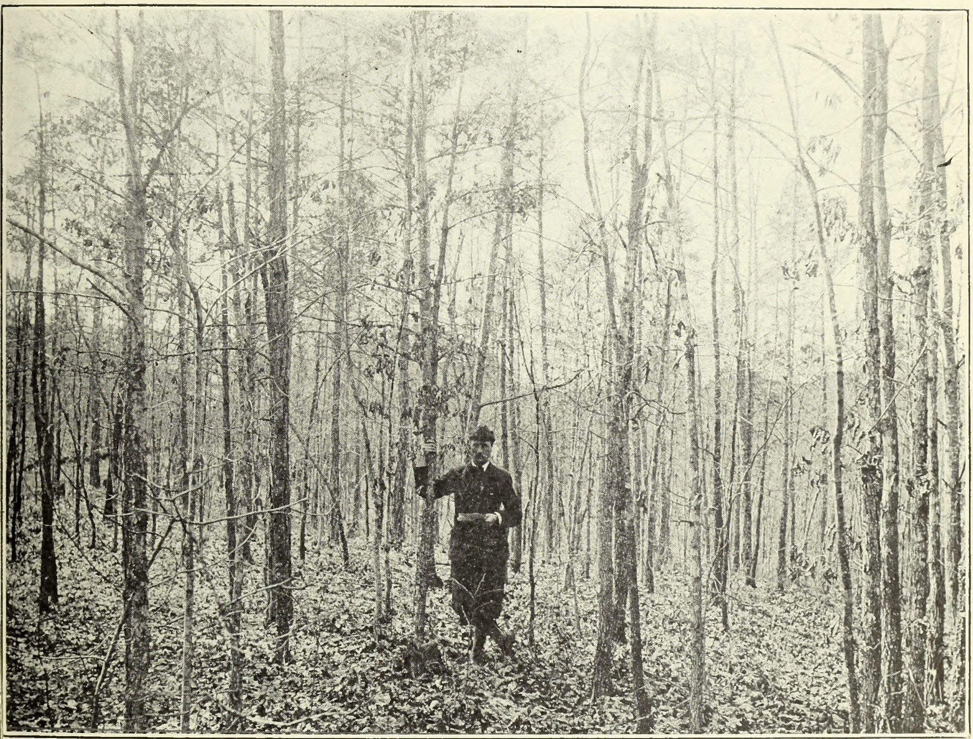


Plate V. The increasing necessity for fire protection. Our future hardwood supply, showing reproduction of white oak, Buncombe County, N. C. Surface fires would absolutely destroy or vitally injure these young trees.

pretty certain that the annual loss through injury to living timber will equal the loss to the forest owners through the destruction of timber from this cause.

INJURY TO YOUNG GROWTH AND REPRODUCTION.

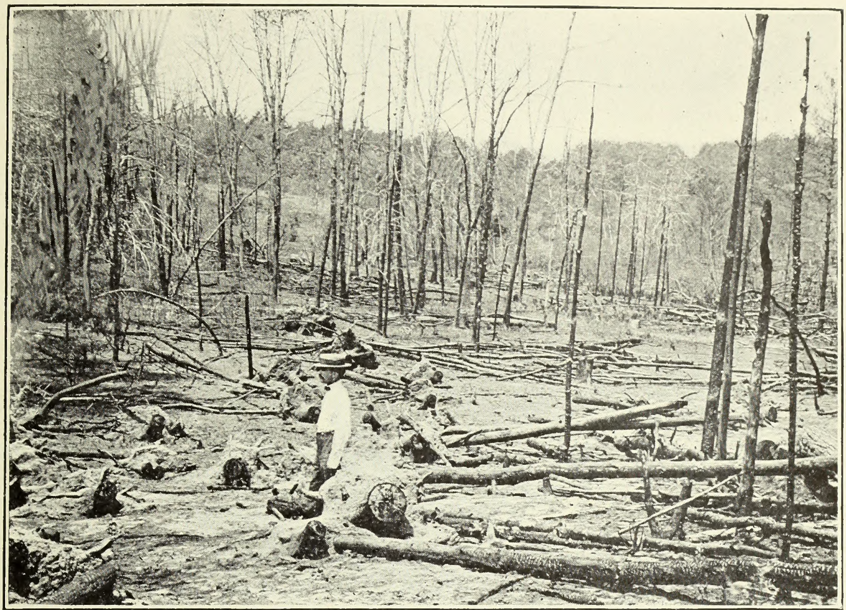
The injury and destruction of standing timber is in most cases not the chief damage done to the forest by fire. Every fire running through the woods, even if only burning the leaves and grass, kills a great part of the seedling growth that should be carefully protected in order to insure a profitable forest growth in the future. All through the woods, especially when lumbering has let in more light and has torn up the ground, quantities of delicate seedlings of the tree species can be found. Yellow poplar and pine, our most valuable trees in the western and eastern parts of the State respectively, are very susceptible to fire when young, and are yearly killed by the million in the seedling size, by so-called harmless surface fires. Even the sprouts and suckers that form such a large proportion of the reproduction in the hardwood regions are easily killed by even light fires. This young growth is so often destroyed while very small, and so comparatively seldom attains its full development, that many people seem to forget its value.

For the future owners of the land the young growth, which is to take the place of the old timber when that is removed, or is already taking its place, has a very real and substantial value, and a value that can be estimated in dollars and cents. This may be seen more plainly from the following example, which is here simplified by the omission of complicated interest and other charges. A stand of second-growth pine forty years old was cut and yielded on an average 40 cords of pulpwood to the acre. This netted the owner a profit of $1 per cord, after all expenses of cutting and marketing were paid. The value of this pine as it stood was therefore $1 per cord or $40 per acre. In cutting this stand a large lot of seed was scattered and the next year the area was covered with pine seedlings. As the ground was not wanted for agricultural purposes, the owner decided to raise another crop of pine on it. He would expect in forty years' time a yield as good as that which he cut off, and a price certainly not any lower. At the end of five years, however, fire got into this area and killed all the young pine. Here was a direct loss of $5 per acre; for if the pine was worth $40 per acre at the end of forty years, it was worth $20 at the end of twenty years, or $5 at the end of five years. But this $5 was not the only loss, nor was it in this case the greatest loss. The old trees had all been removed from this area five years before, and after the first lot of reproduction was killed there were no trees to seed up the area again. So that this land, which had been yielding the owner $1 per acre every year in the growth of the pine, was yielding him nothing. Here, then, was a loss of $1 per acre every year as long as he kept that land, or till he could, perhaps at considerable expense, put it to some other use. But suppose that there were seed-bearing pine trees around this area which would gradually seed it up to pine again. It might take ten years to get a stand dense enough to make a 40-cord crop, so that such a crop could not be expected for fifty years after the fire. There is then here not only the loss of $5 per acre from the destruction of the young pines, but the postponement of the next crop ten additional years, or a loss of $10 an acre in addition, or a total loss of $15 per acre in the destruction of the young growth.

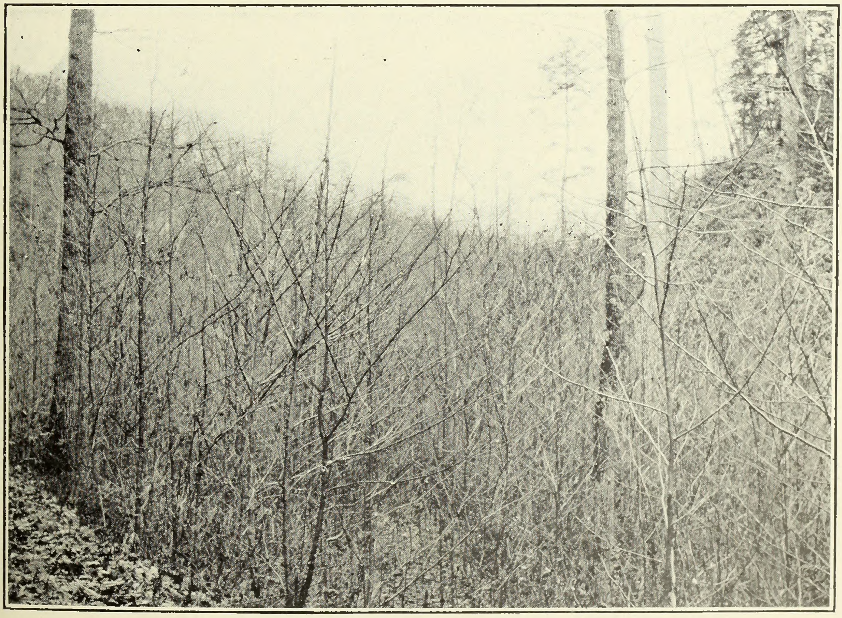
The foregoing is a very fair instance of the loss forest owners in nearly every county of the State are sustaining every year through the destruction of young trees, which is often entirely overlooked by the man who sees in a forest only its present value in timber which is now merchantable.

INJURY BY CHANGE IN COMPOSITION OF THE FOREST.

Frequent fires not only affect the temporary stand of reproduction, but also more or less permanently affect the composition of the forest. The young plants of some species are much more susceptible to fire than others, and the tendency is to reduce the proportion of the more easily killed species in the forest. Several of our most valuable trees are the most easily killed when young, and where fires are frequent these are rapidly disappearing from the forest. Yellow poplar is about the most valuable of the hardwood species and reproduces chiefly from seed. The seedlings of this tree are destroyed even by light fires, and unless these can be prevented, yellow poplar will gradually disappear from our forests. Many of the original stands of timber have contained 10 to 15 per cent of this species. Yet in a second-growth forest it is a rare thing to see as much as 1 or 2 per cent. Among hardwoods the poorer and less valuable trees are as a rule the most resistant to fire. The result of burning, then, is to increase the proportion of these less valuable species. Where fire is frequent our second-growth forests consist largely of the black oak, red maple, black gum, and other species that can better withstand fire. These trees, as is well known, only bring a comparatively low price when sold for timber, so that a forest consisting largely of these species would be worth much less than one in which the more valuable trees, such as yellow poplar, chestnut, linn, white or red oak, form an important part. Chestnut is also a tree that is easily injured by fire when young. In spite of its habit of sprouting from the stump, which often enables the young shoots to escape the worst part of the



A. Hardwood forest burnt over after logging, Watauga County, N. C. All reproduction and most of the second growth has been killed.



B. Hardwood forest protected from fire. Thrifty yellow poplar reproduction, Buncombe County, N. C. A forest fire would destroy this growth.

TWO WAYS OF TREATING A CUT-OVER FOREST.

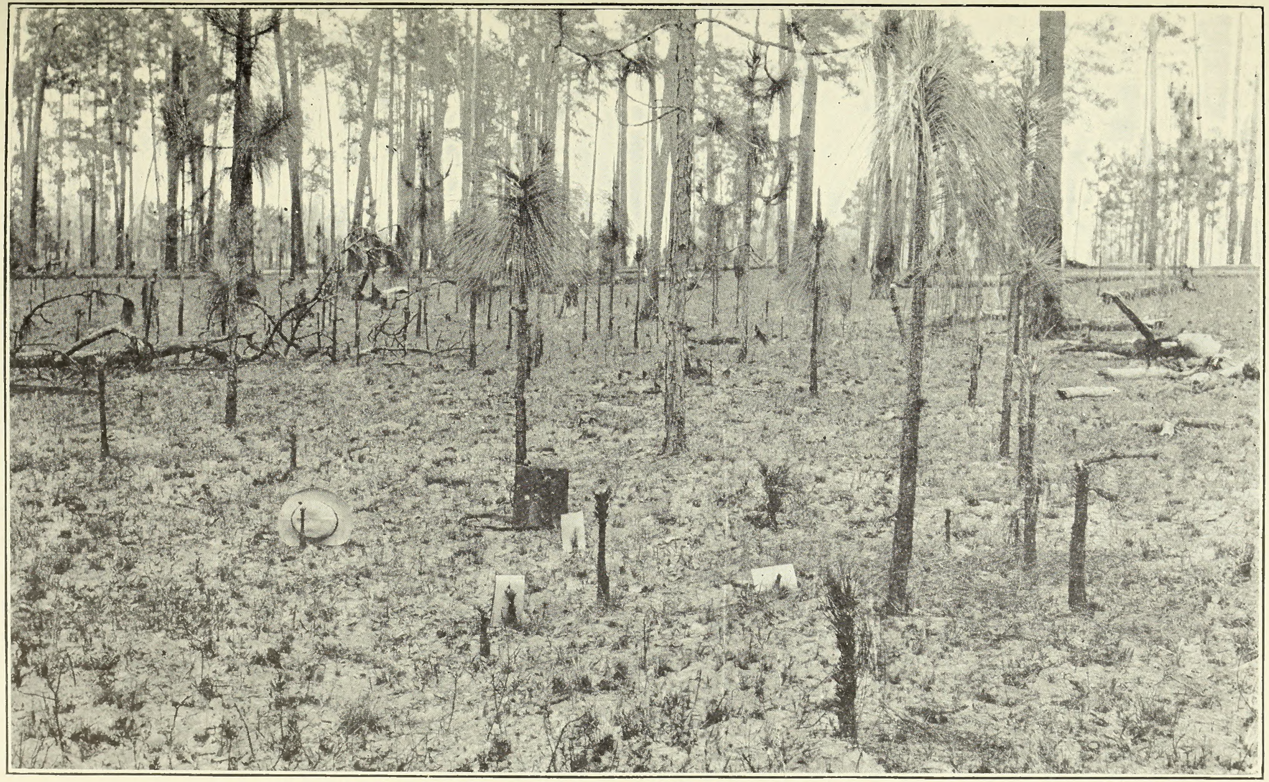


Plate VII. Longleaf pine forest. Seedlings of longleaf pine up to six years of age killed by surface fire.

fire, this tree is fast disappearing from the forests of the lower elevations, and there is no doubt that forest fires are to a large extent responsible.

The same is true to a certain extent of the pine forests of the Coastal region. All through the sandhill country where loblolly pine does not flourish, the original longleaf pine forests have been succeeded by areas of scrub oak, which are absolutely worthless for timber and are of little use even for firewood. It is commonly thought that this scrub oak growth is the natural successor of the longleaf pine after that is cut. This preponderance of oak is due largely, though not entirely, to the practice of burning. The oak is very resistant to fire and grows in spite of the burning, but the pine seedlings which have started and would have probably resulted in a second growth of pine are killed by fire. The result is that this land, which should be producing a valuable growth of pine, is now yielding absolutely nothing to the owner. The elimination of pine from this forest, like the reduction of the percentage of poplar and chestnut from the hardwood forests farther west, is in large measure due to fire.

IMPOVERISHMENT OF THE SOIL.

One of the most serious and universal losses through burning the woods is the gradual but certain impoverishment of the soil. Forest soils, if protected from fire, will not only maintain their fertility, but will increase in richness year by year. The more important food constituents of the soil, after being used by the tree, are returned to the soil by the falling leaves, practically none of the valuable elements being stored permanently in the wood. This process maintains indefinitely the fertility of the soil. When the leaves are burned, nitrogen, the most valuable part of the plant food, goes off in smoke and is entirely lost, while the potash and phosphoric acid are left in the ashes. These ingredients, however, are quite soluble in water, and the ashes being very light, the greater part of this material is carried off to the streams by the first heavy rain. Again, the rotting leaves and twigs form a covering of humus, which is the decaying vegetable matter which is so necessary for the growth of all plants. Without this humus the soil becomes hard and packed and the growth of the trees is very much retarded. The loss to the owner is felt in two ways: first, in the slower annual growth of the timber, and, second, in the reduced value of the land, should it be needed for agriculture. The timber should grow rapidly so that it will take as short a time as possible to mature. Should the owner, however, intend at some future time to bring this land into cultivation, he would want it to become as rich as possible. It has frequently been the custom to allow old fields to produce a crop of pine, and when this is cut off, to again plant cotton or corn. This rotation of agricultural with timber crops can be worked very successfully if fire is kept out of the pine; but if constantly burned over, the land will be no richer, but even poorer, when the crop of pine is cut off, than it was when it was abandoned thirty to forty years previously.

SOIL EROSION.

After burning the leaves off the ground not only are the ashes washed away, but much of the surface soil is removed by the rain. As long as there is a good cover of forest trees this erosion will, as a rule, not extend beyond the surface soil. This surface, however, is generally the most valuable part of the soil, for it not only contains the ashes and decaying vegetable mould, but in it the mineral constituents are more available for plant food because of the direct action of frost and rain. When there is a good cover of leaves on the soil, the water sinks in instead of rushing off, and the loss from erosion is practically eliminated.

This loss from erosion through burning is perhaps even more apparent on cultivated slopes, above which are uncleared forest areas. If this forest land is burned over, the rain falling on it will run off rapidly onto the field below and will cause serious washing in the cultivated soil. If, however, the forest is not burned and a heavy covering of leaves, held together by twigs and brush, accumulates in the woods, the water will not gather above the field, and a great part of the erosion will be prevented. The loss from erosion to the farms of the Piedmont section of North Carolina alone during the wet spell in 1908 was estimated to have been half a million dollars. Much of this might have been prevented by protecting the forested slopes from fire.

INJURY TO STREAMS.

There has been much controversy recently as to the extent of the influence upon stream flow exerted by forests, and it is not proposed here to enter into this discussion. There are certain effects on streams, however, that every farmer and woodsman is familiar with. Every man who has built a fish pond will have noticed that the condition of the area which drains into the pond has a very marked effect on the condition of the water and the usefulness of the pond. If the pond is located in unburned woods, the water is nearly always clear and the pond will never fill up with sand or silt. If, on the other hand, the pond or the streams which feed it are surrounded by cultivated fields, the water will usually be muddy and the pond will readily fill up. This is caused by the surface soil from the fields washing down into the streams. If the slopes, though covered with forest, are kept free of leaves and grass by frequent burning, silt will likewise be deposited to only a less degree than where the slopes are cultivated.

It is a well-known fact that springs surrounded by forests are much less susceptible to periods of drought and excessive rainfall than those in the open. The cover of forest leaves, by preventing the rapid run-off of rain, allows much more of the water that falls to sink into the soil. It is this soil water that eventually goes into the springs. If, however, the woods are burned, the water runs off almost as rapidly as it does from the open field, and much of the water that would otherwise feed the springs runs off at once in the streams, thereby increasing the amount of flood water. Though floods are not due to the removal of the forest, still there can be no doubt that their height and often destructiveness is increased by the removal of the forest, and also, to a very large extent, by the destruction of the leaf cover in the forest by fire.

CAUSES OF FOREST FIRES.

The study of the causes of forest fires is the most practical way of finding out the best method of preventing them. So that, though last in the list of inquiries sent to correspondents, this is one of the most important questions put before them. Out of the 156 correspondents who sent in replies only 94 answered this question. Some, however, gave two or three principal causes for the various fires in their locality. These causes are here tabulated according to the number of times they have been mentioned by the different correspondents and not according to the number of fires attributed to each cause.

TABLE 7.—FOREST FIRES IN NORTH CAROLINA IN 1909. CAUSES OF FIRES, BY FOREST REGIONS, AS GIVEN BY CORRESPONDENTS.

	Mountain.	Piedmont.	Coastal.	State.	Percentage.
Carelessness	6	6	3	15	10.8
Negligence	1	1		2	1.5
Farmers burning brush, etc.	4	7	3	14	10.0
Hunters	6	8	9	23	16.0
Campers		3	1	4	3.0
Matches, cigar stumps, boys, etc.	1	2	1	4	3.0
Railroad locomotives	3	6	14	23	16.0
Railroad section hands			2	2	1.5
Logging locomotives	1		5	6	4.3
Lumbermen			1	1	.7
Sawmills	2	3		5	3.5
Burning building		1		1	.7
To improve the range	4		1	5	3.5
Chestnut gatherers and root-diggers	2	1		3	2.0
Without much object, to see it burn, etc.	15	2	1	18	13.0
Malice	4		1	5	3.5
Unknown causes	2	1	7	10	7.0

Of the various causes to which fires are attributed by correspondents, 100 answers can be classed as unintentional and 31 as intentional. The remaining 19 attributed forest fires to unknown causes.

UNINTENTIONAL CAUSES.

Practically all of the unintentional fires, except those caused by railroads, are due to the carelessness or negligence of the owner of the woodland or of some one who uses the land with or without his consent, so that the owner of the land is the man to take the initial steps to lessen the frequency of fires. Sixteen of the answers attributed forest fires to carelessness and negligence without specifying what form it takes, while most of them more specifically go to the root of the matter.

FARMERS BURNING BRUSH, ETC.

This report is written chiefly for the benefit of the farmers of the State, both because they own the greater part of the forest land of the State and because it is only through them that any permanent reform in the methods of handling our forests can be instituted. It is for this reason that the escaping of fire from farmers burning brush, grass, etc., is the most important of all the causes of unintentional forest fires, because the farmers themselves must begin by correcting their own carelessness, thus demonstrating their own good faith, in the campaign to prevent forest fires. These fires are very often not started by the owners of the land themselves, but by their renters, who have little or no land or other property of their own that can be damaged by fire.

Fires started in this way usually destroy more timber and do greater damage per acre in other ways than those occurring from any other cause, because they commonly occur in a dry time, usually in the spring, often after the sap has started to rise, and because they occur near the homestead or in a settled community, where often the woods have not been burned over for many years and where fences and buildings are endangered and are frequently destroyed.

In clearing up fence corners, briar patches, old fields, and other areas of grown-up or waste land, preparatory to putting in a crop, burning is too often resorted to. There is always very great risk of fire getting away in the dry windy spring days, and when it does, not only is tremendous damage done to fences and timber, but much loss of time is incurred fighting the fire, in the busiest time of the year.

Fire is used much too often in clearing up farm land. In nearly every instance the leaves, dead grass and other rubbish which are destroyed by the fire would add much to the quality of the soil if plowed under, and this could generally be done at little extra cost or trouble.

The little piles of briars, bushes, and roots that are usually burned could much more profitably be used in stopping washes or filling gullies. Vegetable matter should never be burned from the surface of land intended for crops, as all such material plowed in adds that much humus to the soil, thereby enriching it and greatly improving its physical condition.

HUNTERS.

By reference to the table it will be seen that the carelessness of hunters is thought to be the most frequent cause of fire in the Piedmont section of the State, and second in importance in both the other regions. This menace of the hunter is a very serious problem. The dangerous hunter usually is abroad at night, often walking miles from home. He builds a little fire in the woods while waiting for the dogs to "tree," and then goes off and leaves it burning; or he puts fire in a hollow tree to drive out a rabbit or a 'possum, and leaves it to burn out because he cannot easily extinguish it. Occasionally the day hunter sets out fire by the ignition of a gun-wad, or by throwing down a lighted match, or by leaving a fire by which he has warmed himself and eaten his lunch. It is very hard to find who are the hunters guilty of setting such fires, both because it is mostly done at night and because it is usually done far from any house. The hunter as a rule does not mean to set out fire, but in the excitement of the chase, or his desire to get home to bed, he does not take the trouble to see that the fire is put out.

This evil can best be combated by calling the attention of the hunter to the strong desire of the owner of the land to keep fires out, by putting up printed notices to that effect and by letting it be known in other ways. The law requiring a hunter to obtain the written consent of the owner of the land, which now only applies to certain counties, should be extended to the whole State. Such a permit system works no hardship to the legitimate hunter, but it helps him to realize that he is receiving a certain privilege from the owner of the land and that he should in return do his best to see that no injury results to the property through his being there. It has a tendency, also, to discourage the careless and irresponsible hunter who has no thought for the rights of his neighbors and does not want his presence on the property known.

CAMPERS.

The spread of forest fires from unextinguished camp-fires seems to be more frequent in the Piedmont than any other region of the State, though even here it is of secondary importance. Fires from this cause should in the future become less and less frequent, as with moderate care they can be pretty well controlled. In the first place, there is a strong law in the State against leaving a camp-fire unextinguished. A man who does so is liable to a fine of $50, whether any damage results from such fire or not. Again, camp-fires are nearly always made beside the road, where the passer-by can readily discover it, and easily trace up the one who lighted and left it. Again, camping is usually done in the summer, when the grass and weeds are green. At such times it is very hard or almost impossible to set fire to the woods. It is only in the autumn, after the leaves start to fall, or during a very dry spell in the late summer, that there is much risk from campers. By putting up printed notices along roads frequented by wagoners, near springs and other camping places, calling attention to the law relating to this subject, and by successfully prosecuting now and then one or two offenders against this law, the practice of leaving camp-fires burning could virtually be stopped and the annual damage from forest fires resulting from this practice would soon be practically eliminated. Camp-fires should never be built against large logs or dead standing or down trees, as after these get thoroughly started to burn it is almost impossible to extinguish them, and a fire readily spreads from a standing or down dead tree to the adjoining woods.

Fires lighted by men at work in or near the woods in cold weather, in order to warm their dinner or their hands, or just to light their pipes, are really a greater menace to the forests than genuine camp-fires. Though the man is probably somewhere about the fire all day, still after the sun gets warm or he gets interested in his work, he forgets all about the fire and it is very liable to get into the brush, or into a rotten or doty log, where it is very difficult or almost impossible to put it out. Such logs may smolder for days and then suddenly a fire break out, and the very man who set it will wonder how the fire started. The greatest care should be exercised in making any fires in the woods, and never should a fire be built against a rotten or doty log or standing dead tree.

MATCHES.

There is no doubt that many fires originate from the careless throwing away of matches, cigar or cigarette stubs, and from children playing with matches. In very dry weather it is exceedingly easy to set fire to a bunch of dry grass, and even leaves, by just throwing a match into it, and by the time the fire is visible the smoker has passed on. It is not hard to blow out a match, or to grind a cigarette stub into the ground with the foot—if one thinks of it. The forest rangers on the National Forests of the West make a practice of rubbing cigarette stubs out against trees or rocks before they throw them down; and in dry weather that practice would be advisable here. Children are often accused of setting out fires in grass or leaves. It is, however, generally the parent's fault if children are careless with matches. If they are taught to be careful with fire, and are brought up to look on a forest fire as a calamity, there will be very few fires that can be attributed to their play.

The above causes of unintentional forest fires can be classed as individual, that is, they are caused by private individuals. These are very often persons without property or other responsibility, and so are the hardest class to appeal to for improved methods, or to control with the law, as they often have not enough property to make them legally responsible. Forty-one per cent of the answers given fall under the above head.

The remaining causes of unintentional forest fires can be grouped together as resulting from carelessness or negligence on the part of some business firm or corporation, mostly railroads and lumbermen. This class of fires may in the future be more readily controlled than those due to individual carelessness, for as soon as there is a more general demand from the landowners of the State for fire protection, the business men will soon recognize that their interest lies in acceding to that demand.

RAILROADS.

More correspondents attributed forest fires in this State to railroad locomotives than to any other one cause. It may be that the railroad gets the credit for some fires that originate from other causes, but it is certain that the indifference of railroad management, together with the carelessness of their employees, for which, of course, the railroads are responsible, is one of the chief menaces to our forests from fire. Under ordinary conditions sparks from the locomotives are small and fall on the railroad right of way. If this were kept free from brush and other inflammable material little harm would ensue. This, however, is not done; so fires very frequently start on the railroad's own property. The greatest danger is on stiff grades, where, with forced draft, large live sparks are often thrown out. In a high wind these may be carried for considerable distances, up to 100 or even 200 feet, often setting fire directly to the woods of the adjoining landowner. In places such as these, where the danger is greatest, the railroad and the owner should coöperate by clearing a wider strip clear of inflammable material. Fires frequently start from the burning of old ties or other rubbish by the section hands or by letting the fire escape when they are burning off the right of way. Some coöperative arrangement whereby the landowner would assist the section hands in burning off a strip two or three times the width of the right of way through forest land would be of mutual advantage, and would practically prevent fires from these causes. It is strongly to the interest of the railroads to do all in their power to protect the forests from fire. These forests furnish the greater part of their freight in many counties, and by keeping out fire they would be greatly increasing their future freight tonnage.

LUMBERING.

The danger to the forests from fire due to logging operations is of the same sort as that due to railroads, but it is much more variable. Some lumbermen seem to do everything in their power to keep out fire, while others are absolutely indifferent to it. Of the seven correspondents attributing forest fires to logging engines and lumber hands, six were in the eastern part of the State. This is due in part to the fact that logging roads are more common in the Coastal Plain region, but it is also because the large lumbermen, in the western part of the State, are most anxious to keep out fire. One company in the mountains has standing orders for its log-train crew to stop the train to put out any fire that may have been started by the engine, and for any or all of its hands to drop what work they may be engaged in at any time to go and extinguish a fire. Another company in that region carries spark arresters in its engines. These are said to be quite efficient when in good order, but they need renewing quite often. Lumber companies when operating on their own land usually see the importance of protecting the forests from fire, while those logging on other people's land, having no future interest in the forest, do not usually take much trouble to keep fire out. In this case, it is more the fault of the owner, in neglecting to insist on proper fire protection when selling the timber, than it is that of the operating lumber company.

SAWMILLS.

Stationary steam sawmills usually necessitate an expensive plant, with large amounts of lumber stacked around, so that there is every inducement to protect these from fire. Portable sawmills, on the other hand, move from place to place, setting up right in the woods, cutting a small amount of lumber in a place and then moving on; the millmen sometimes owning the timber, but rarely owning the land on which the mill is set. It is these portable mills that, according to five of the correspondents, are responsible for fires in the Piedmont and western parts of the State, where this kind of mill chiefly flourishes. Several of the mountain counties have from fifteen to twenty-five such mills at work in them. In this case, again, it is the owner of the land as much or more than the millman, who is responsible, for he should stipulate that every precaution against fire must be taken before he allows the sawmill to come onto his land. There are quite efficient spark arresters that can be used on portable engines such as those used for sawmills, threshing machines, etc., and operatives should be compelled to use them. If the owner of the forest takes no precaution against fire, he cannot expect those using the land to do any better.

Forest fires resulting from all the foregoing causes, though unintentional, may be said to have been avoidable; that is, with proper care on the part of the people concerned, and watchfulness and foresight on the part of the owners, they should never have occurred. There are, however, accidental causes, such as lighting or catching from a burning building—which was the cause of one fire in the Piedmont region—that cannot be foreseen or guarded against any more than the loss of the building itself. Lightning is the cause of a great many forest fires in the semi-arid States of the West, but here in the East, where thunderstorms are rarely unaccompanied by rain, which will in most cases extinguish a fire if once started, fires from this cause are quite uncommon. Occasionally, a dead pine is struck and set on fire, and if not extinguished by the rain, a forest fire may result. These accidental fires, however, are not the ones we want to discuss. They are extremely rare and their occurrence is of more concern to the statistician than the economist. Preventable fires are what this study has to deal with, and by far the largest proportion of the fires fall under this class.

INTENTIONAL FIRES.

About 23 per cent of the answers give causes that can be classed as intentional, though in reality probably a much larger proportion of the forest fires occurring over the State are set on purpose. Many people do not think that a fire in the woods attains the rank of a forest fire if it is set for an object and destroys no standing timber. One of the chief causes of forest fires, especially in the Coastal Plain region, was never once mentioned by correspondents, probably because fires started for this purpose were not considered as forest fires. Protection fires are here referred to.

PROTECTION FIRES.

It is claimed by many farmers and other residents, especially of the eastern part of the State, that by burning off the dry leaves and grass during favorable weather, in the winter, when the fire can be kept more or less under control, much worse fires, coming perhaps in the dry spring months, and destroying much timber and other property, are prevented. This is a wrong principle to work on, though in certain cases, as a temporary expedient, its practice may be justified.

The present careless method of doing this, however, cannot be too strongly condemned. Section 3346 of the Laws of North Carolina expressly provides that no one shall set fire even to his own woods without first giving all adjoining landowners two days' written notice and also taking effectual care to extinguish such fire before it can leave his land. This law was passed because it was felt that it was needed, and it has remained on the statute-book for the same reason; and yet it is constantly disregarded, in fact, is very seldom fully carried out. Fires are set to protect fences and outbuildings and sometimes even dwelling-houses, to protect ties, shingles, cordwood, or other material remaining in the woods, to protect standing timber, and especially turpentine orchards.

In burning to protect fences, etc., only a narrow strip should be burned, confining the fire to a few furrows made with a plow, where possible. Care should be taken to prevent unnecessary burning around shingles, cordwood, etc. The practice of burning off a whole area where ties are going to be cut is most destructive. Ties are very often the last thing to be cut on an area, so that in working them up the forest should be left in the best possible condition for the future crop. Burning destroys or seriously injures the future crop.

Raking around the trees and burning when the woods are damp may be the best way to protect a turpentine orchard under present conditions, but if the timber is to be cut as soon as the crop is finished, very great risks are run of destroying, through burning, all the future usefulness of the forest. Longleaf pine produces seed to any considerable extent only every three to five years, and for that length of time before the trees are to be cut great care should be taken to preserve all seedlings that start. Burning and the hog destroy practically all of the longleaf pine reproduction.

Burning to protect standing timber is never advisable with the hardwoods. Even the little fires scorch the bark of the trees, doing great injury by letting in insect and fungus diseases. Most of the owners of hardwood timber in the State are now making earnest efforts to keep fire off their land altogether. Where unboxed pine timber is to be held for several years, some owners advocate burning for protection. There can be little doubt, however, that the loss from destruction of young growth, and the loss of growth in the timber itself, resulting from the impoverishment of the soil, will more than offset the immunity from serious fires.

"IMPROVING" THE RANGE.

Perhaps the most widely used excuse for burning the woods is the plea that it improves the range. It is claimed that by burning off the dead grass and leaves in the winter, the grass will start earlier in the spring and the cattle will be able to get through the woods better to get at it; that if the woods are not burned they will grow up and gradually kill out the grass. This, in some cases, no doubt is true. But even though the early pasture may be made more available, the range as a whole is nearly always decidedly injured by burning. The better quality of grasses and most of the valuable native forage plants, such as the beggar lice and other peas, are discouraged or entirely killed out by the fires, and the soil, becoming poorer and poorer each year, cannot furnish as much forage as if it was not burned. The principle that all land should be put to its highest use should be borne in mind. If the land is more valuable for pasture, it should be cleared, so that as much and as good a pasture as possible could be made on that area. But, on the other hand, if the land is more valuable for forest growth than for anything else, the younger tree growth is what is wanted and every effort should be made to encourage it.

CHESTNUT GATHERERS.

The woods, especially in the western part of the State, are frequently burned by chestnut gatherers, root diggers and mineral hunters. As the leaves and the fruit of the chestnut fall about the same time, fires are often set to clear the ground so that the chestnuts can readily be seen and picked up. In the same way the woods are occasionally burnt off in the winter and spring, so that the first spring leaves of the ginseng or other marketable herbs can easily be found. Mineral hunters, also, sometimes burn off the woods so that the surface indications can be seen by just walking over the ground. Burning for these causes is nearly always done on lands belonging to some one else, by irresponsible people with little or no land of their own. Such burning comes clearly within the scope of section 3346 of the Revisal, making those who set such fires subject to a heavy fine as well as to damages. The great difficulty, of course, is to secure sufficient evidence to convict before a jury that is indifferent to forest fires. This drawback will gradually right itself with the awakening of public opinion, and as the amount of money made in these ways becomes less and less, and the number of people following these vocations diminish, the number of fires from these causes will gradually decrease.

NO PARTICULAR REASON.

There seems to be born with the backwoodsman an inherent desire to burn the woods. The early settlers looked upon the forest as an enemy; something to be conquered and destroyed as rapidly as possible. Many of the present generation seem to have grown up with the same idea. The most trivial excuses are often given for setting fire to the forest, as, for instance, the killing of snakes or ticks. As the snakes and the ticks are in the ground when the burning is usually done, and so are not hurt by the burning of the leaves, this seems a childish excuse. It is also pleaded that if the woods are not burnt now and then they will get too dense to walk through with comfort—as if the chief object of keeping woodland and paying taxes on it was to have an open place to walk in! The denser the undergrowth, the better the timber will be, and the more young growth there is to take the place of the old timber, the greater will be the future and also the present value of the forest.

About half the correspondents in the mountain counties who referred to the causes of forest fires gave it as their opinion that fires were chiefly set by the loafing, irresponsible class, by men who have no property and little interest in the advancement and prosperity of their community. A few quotations from these correspondents will give an idea of what kind of people set out forest fires, and how they are thought of in their own community. In answer to the question "What are the causes of forest fires?" the following replies were given:

"People passing along and setting it on fire";
"Done more to see it burn than anything else";
"Men who own no forests set them out";
"Set out by lawless citizens";
"Just to see the leaves burn";
"Fire set privately in the woods";
"Done by men who do not care for the damage it does";
"Fired by careless boys, generally";
"Incendiary people who want to destroy";
"Stragglers setting fire to the leaves";
"Trifling, careless men setting it secretly";
"Set out by thoughtless and careless persons who seem not to care what the result will be";
"Set out by men hunting and loafing around in the woods."

Such comments as these indicate a distinct and intelligent sentiment against burning the woods. This is the ruling feeling in the better settled counties, and even in the rougher regions the great majority of the landowners deprecate the frequency of forest fires. All of which seems to indicate that we are at the dawn of an era of forest protection in this State.

MALICE.

So far only accidental fires, chiefly those due to carelessness and negligence, have been dealt with, and intentional fires set by persons ignorant of or at least indifferent to the injury that would result to the landowner. There are, however, unfortunately, some fires set each year for the express purpose of injuring some one. Four correspondents in the mountain counties and one in the Coastal region attributed forest fires in their counties to malice. Setting fire to and destroying a man's crop of pine poles or locust posts or other forest crop is just as felonious as burning his hay or oat crop, and should receive just as severe punishment; and setting fire to the leaves or grass on purpose to burn a man's fence is exactly the same kind of crime as setting fire to a straw stack on purpose to burn his barn.

In trying to "get even" with some company or owner of forest land, or with some one employed by them, by injuring or destroying their forest property, a man really injures himself and his community a great deal more than he does the owner of the timber, even looking at it merely from a material point of view. That is, the owner loses only the value of the timber as it stands and the net profit that he would make on manufacturing it, while the community would lose all the money that should be paid out to local men manufacturing this timber from the tree into the finished product. A single example will bring out the point more clearly. The Forester to the North Carolina Geological and Economic Survey, after spending several days in the mountains of Graham County last summer, estimated that at least five million feet of timber had been destroyed by fire in that county in the past five years. This timber would have been worth from $1 to $3 per thousand as it stood, or a total value to the owners of about $10,000. If this timber had not been destroyed it would in the regular course of events have been cut, manufactured and sold within a few years' time at approximately the following cost: Cutting and logging to the mill, $6 per 1,000 feet; sawing and stacking, $3 per 1,000; hauling to railroad and loading on cars, $1 to $11 per 1,000, or at a total cost of from $10 to $20 per 1,000. Practically all of this money would have been paid out to local residents and circulated through the neighborhood; so that the community suffered a loss of from $50,000 to $100,000 through the destruction of this $10,000 worth of timber belonging to other parties. If it were more generally recognized that the burning of the woods involved not only an individual loss to the owner, but a really much greater money loss to the community, more care would be taken to prevent fires, and greater efforts would be made to apprehend and punish the miscreants who intentionally set fire to the woods.

UNKNOWN CAUSES.

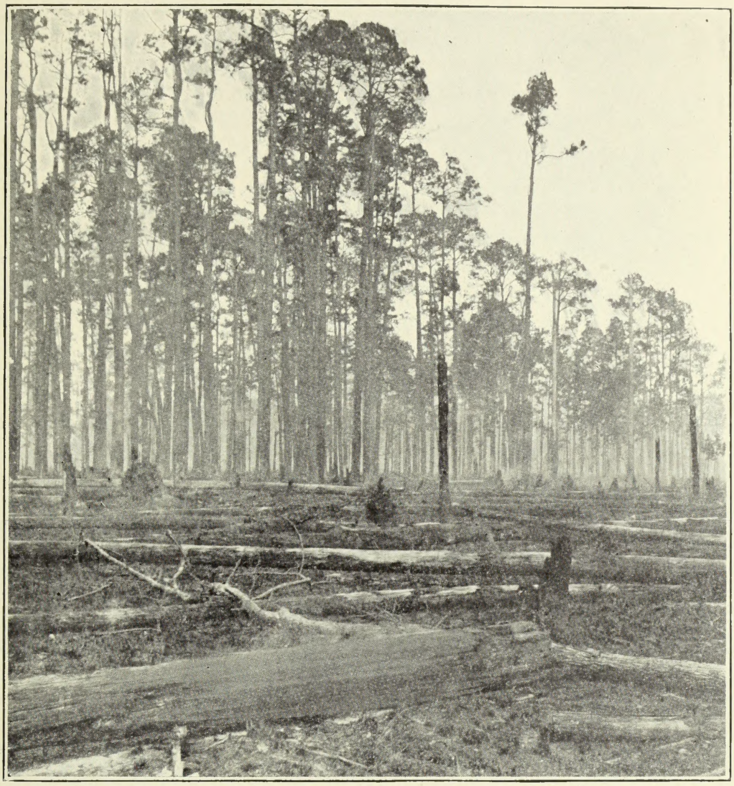
It is quite remarkable how few correspondents attributed forest fires to unknown causes. This seems to show that, when fires occur, people have a pretty good idea of how they are started and who sets them—enough to satisfy themselves in their own minds, though sufficient evidence may not be available to prove a case before the courts. It seems evident, therefore, that as the feeling against burning grows stronger, and the average jury becomes anxious to punish such lawbreakers, it will not be found so difficult to apprehend and convict the incendiaries as many people are now quite prone to think.

PREVENTION OF FOREST FIRES.

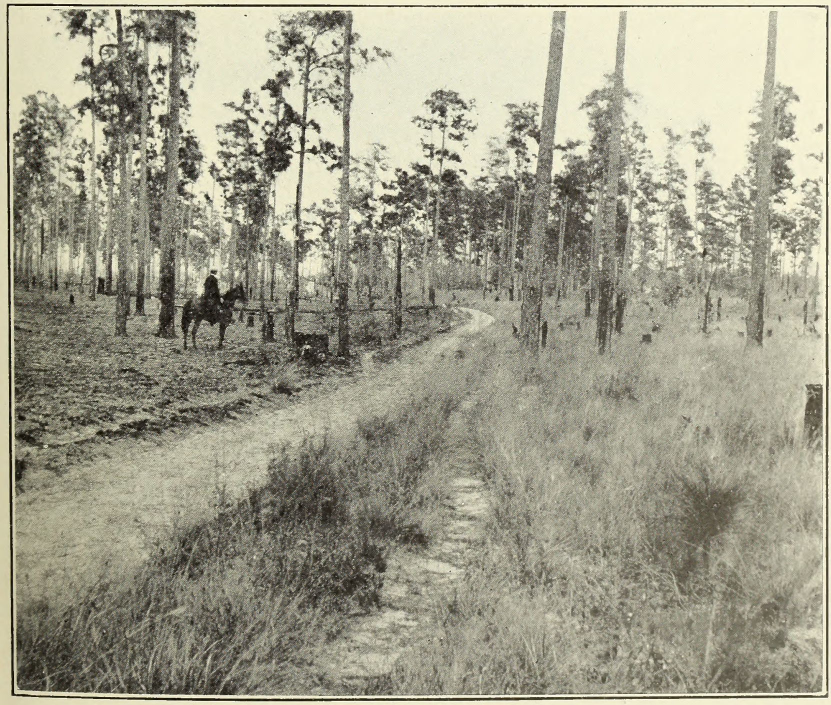
It is generally admitted by the most enlightened and progressive people of this State that forest fires are very destructive, and are a great misfortune to the community. Many men, however, without seriously thinking of the question or making any effort to improve these conditions, claim that the common practice of burning the woods cannot be prevented. Yet all experience goes to prove that damage by forest fires is practically preventable. In Europe, where burning a man's woods is looked upon in the same light as burning his barn or his house, the one is almost as rare as the other. In the forests of Prussia, for example, with an area of approximately two-thirds that of the North Carolina forests, during a period of thirty years only one-fiftieth of one per cent was burned each year. This was not due to a difference in the nature of the forest, since much of the area was dry sandy pine land quite similar to our own eastern forests. How does this compare with the 5 per cent or more burned over in the forests of North Carolina? It is quite true that if no measures are taken to prevent fires, we cannot do much to improve the present conditions; but there is no doubt that fire protection is practicable and can be effective as soon as we come to the conclusion that it will pay.

PUBLIC OPINION.

The first and most important thing that must be done toward preventing this annual loss from fire is to bring about a change in public opinion. As soon as the mass of timber owners and timber users of the State are persuaded that fire protection is desirable and practicable, then and then only will protective measures succeed. This is a work that every one can help in by practicing and preaching fire protection. A few men can get together and get laws introduced and passed by the Legislature, but these laws (though good in themselves) will have little effect unless public opinion is behind them. What is needed in North Carolina more than anything else is a strong sentiment against fire in the woods. This sentiment is found to be quite strong in many of the better settled counties, and it is gradually spreading over the rest of the State. When people realize that it is their pocket that is being affected, they will make greater efforts to protect their property.



A. Effect of boxing and fire. Pine forests laid waste in Coastal Plain region.



B. Fire prevention. Road used as a fire break with complete success in a long-

STOCK LAW.

As we have previously seen, one of the most fertile and widespread causes of fire is the practice of ranging the cattle in the open woods. At present there are large areas in the mountain counties of the State on which all kinds of stock are allowed to run at large. Practically two-thirds of the Coastal Plain region is also outside of the operation of the stock law. This fact greatly increases the number of fires in these two regions, and is one of the chief causes of the great difference in the number of fires, as seen in Table 1.

As some people may not understand what is meant by the stock law, a brief description of its workings is here given. The stock law is a local-option measure which, by a majority vote, any county or part of a county may make applicable to itself. Where the stock law is not enforced, cattle, hogs, and other domestic animals are allowed to range through the woods at will, whether the owner of the stock has any land or not. This compels every farmer to put a fence around his crop to keep his neighbors' stock from destroying it. With the introduction of the stock law, however, the owner has to fence his own stock and is responsible if it wanders onto his neighbors' land, so that only pastures need be fenced, and cultivated land is usually unfenced. This system is certainly better for a well-settled community. Even for a thinly settled region, the open range can only be justified on the ground that the ranging of stock does no injury to the owner of the land, as one of the first principles of law is that a man must be protected in his property. One of the chief deterrents to the introduction of the stock law now is the fact that a new district coming under its jurisdiction has to fence itself against the surrounding region in which stock run at large. This is unjust and an imposition, for the people who benefit by the open range should be willing to keep their stock from bothering those who do not want it. A much better plan would be to compel all counties that do not want to come within the benefits of the stock law to fence themselves, and so keep their stock from wandering upon the surrounding district, and the law should be changed in this way. A still better way would be for the people of the east and the people of the west to decide that they have had enough forest fires, and go to the next Legislature and demand that the stock law be extended to the whole State by enactment of the Assembly.

By treating the forests as other private property and preventing stock from running at large in the woods, a great stride will be made toward the prevention of fires in those regions. A man who runs his own stock in his own woods will not, as a rule, burn those woods, because he realizes that the injury done to the forest is immensely greater than the benefit to the range from burning. There is no more reason why a man should submit to having his woods burned for the benefit of his neighbors' cattle than there is that he should have his corn crop ruined to feed his neighbors' hogs. It is generally admitted that no attempt can be made to control the Texas cattle fever or eradicate the fever tick till the county or community passes a stock law. In the same way the introduction of the stock law should be the first step in fire prevention.

FIRE LAWS.

North Carolina has two excellent laws against burning the woods, though this fact seems to be very generally lost sight of by the majority of people. If these two laws were strongly enforced, a very great deal could be accomplished in the prevention of fires. There are, however, certain laws which are working very well in several other States that would help very materially in the work of fire prevention. Perhaps the most important law, and the one that North Carolina needs most, is a local-option measure which will permit any county or township to employ a man for the special purpose of preventing and extinguishing forest fires in his county or district. Such a man, often called a fire warden, would patrol the wooded regions of the county during dry weather, and if a fire was discovered would be empowered to summon necessary aid to extinguish it. He would investigate the causes of fires, and bring to justice those responsible for them. His remuneration should come partly from the township or county employing him, and partly from the State. One or more energetic men in each county would do more in preventing fires than a dozen men could do by waiting till fires start and then trying to extinguish them.

Another law which has worked well in States similar to our own compels farmers and others to notify such a warden or other county authority when he wishes to burn brush or grass during exceptionally dry weather. As we have seen before, a great portion of our most serious fires are caused by the burning of brush in the dry spring weather by irresponsible people. This law would in large measure do away with such fires. All laws, however, must be backed by public opinion to be most effective; so that the first and most important thing to do is to educate public opinion.

RAILROADS.

The railroads of the State are responsible for a great many of the forest fires. They seem to lose sight of the fact that by protecting forests along their lines they would be adding to their future business by increasing the supply of available timber. In other States the railroads

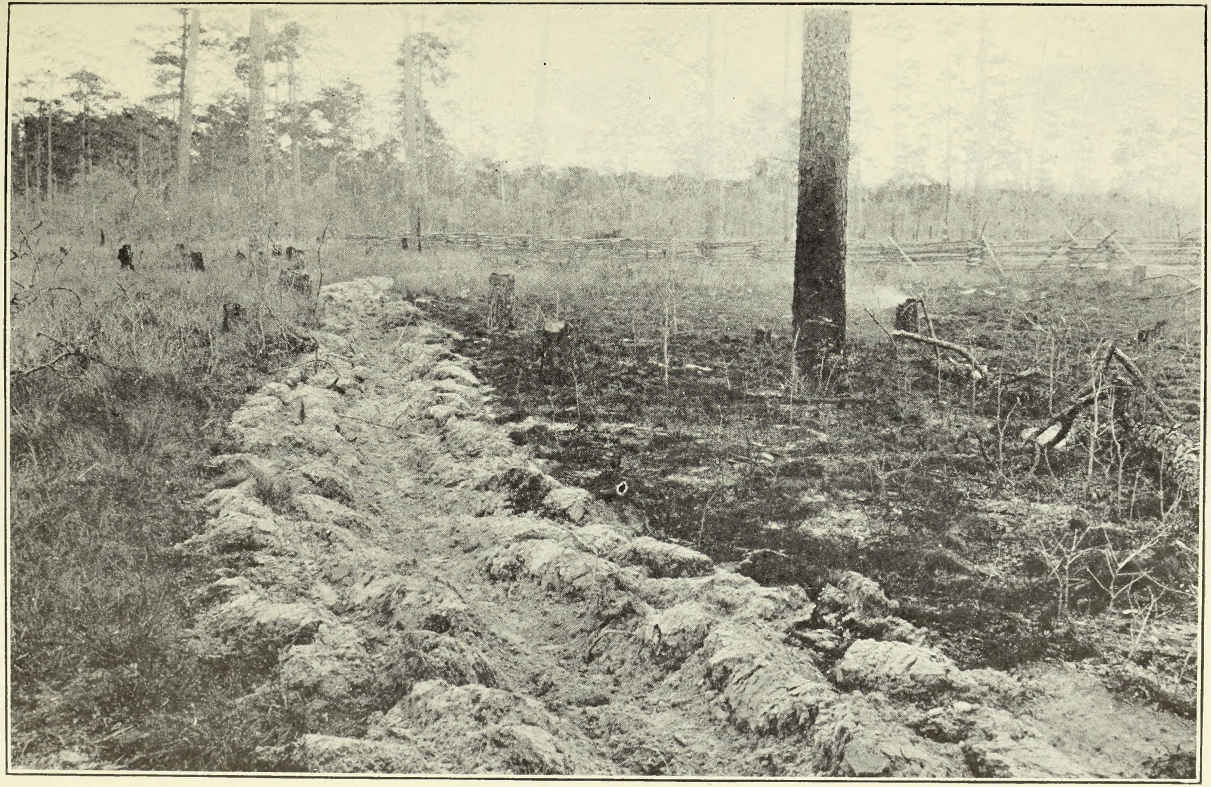


Plate IX. Fighting fire with the plow. Surface fire in pine forest stopped by plowing two double furrows.

have done little or nothing to prevent the spread of fires from their lines until compelled to do so by law. Such negligence on their part in North Carolina will compel the State to pass laws obliging them to do their part toward protecting the forests along their lines from fire. Many States oblige the companies to keep efficient spark arresters in all of their locomotives. Some of the lumber companies in this State have introduced spark arresters with very considerable success, thus adding very much to the security of their own property from fires. The public railroads of the State should do the same. Most railroads keep their right of way cut off for a short distance on each side of the track, but this area should be kept clear of all inflammable material. By coöperative arrangement with adjoining owners, a strip two or three times the width of the right of way might be kept clear, thus adding tremendously to the effectiveness of any protective measure. Such arrangement, however, would not be entirely a matter of law, but would also depend on the willingness of the owner to coöperate with the company. During dry seasons the railroads should patrol their lines to extinguish any fires that might be started from the locomotives, but this again could be made much more effectual and be done much more thoroughly if some coöperative arrangement with adjoining owners could be made. Such coöperative agreements have been very successfully carried out in several of the States, and the management of the National forests of the West have effected similar arrangements with some railroads. The railroads, however, cannot be expected to carry out an expensive protective policy unless the adjoining owners show some interest in the work and are willing to coöperate with the railroads in any way that they can.

FIRE PROTECTION.

Besides these general educational and legislative measures, much can be done to protect the property of the individual from fire. For the lumber company or other forest owner who desires to protect his own property from fire, three very important measures are recommended: (1) The construction of fire lines; (2) the employment of patrols; and (3) the posting of notices.

FIRE LINES.

Fire lines are lines of more or less open area, cleared of grass and leaves and other inflammable material. Such lines may be roads, trails, streams, etc., where fires may be stopped or from which back fires may be started. Many forest tracts in the mountains have their principal boundaries on the tops of ridges or along streams. In such cases it is easy to work out lines that will stop ordinary ground fires. A trail 3 feet wide along a ridge will generally stop a fire, as fires do not readily start downhill.

Logging roads and wagon roads kept clear of leaves will, under ordinary circumstances, stop even a heavy fire. By using such natural fire lines and by making some where these are wanting, a system of fire lines sufficient to make the average timber tract comparatively safe from fires can be constructed at very moderate cost. A fire line 10 or 12 feet wide can be chopped and grubbed out in the hardwood regions of the State for from $10 to $15 a mile. In the more level Coastal regions fire lines can be constructed quite cheaply by plowing two parallel strips 3 or 4 feet wide from 50 to 100 feet apart and carefully burning off the enclosed area at a time when there is little risk of the fire spreading. Such a fire line, when once made, costs little to open cut each year. It has been found, however, in practice that the intermediate ground will not always burn off readily every year, as in the poorer sandhill country sufficient grass and leaves will not accumulate in one season for this purpose. Under such conditions, a third strip would be plowed on one side or the other of the line plowed the previous year, thus making two protected strips, one of which can then be burned off every alternate year. With such fire lines around a forest property, and a few others dividing the area up into compartments so that should a fire originate on the property itself it could be stopped by an interior fire line, quite effective protection can be secured.

FIRE PATROL.

The one thing that has contributed most towards the success of fire prevention on the National forests and on State lands in the East has been a system of patrol. Men employed to patrol a property during dry seasons are ready to extinguish any fires that may be set, and thus prevent small fires becoming large and unmanageable ones. The success of patrol, however, consists still more in fire prevention. If it is generally known that men are watching a property, hunters and loafers and other dangerous persons are liable to be very careful, so that much fewer fires originate than if no one were watching the tract. Some forest properties, even in North Carolina, have patrols employed regularly the year round, though in wet seasons and at other times when there is little danger from fire, these men may be employed in road building, surveying, or other work connected with the property. It has been found that even in regions where burning is the common practice, such patrol has in a large measure prevented serious fires.

FIRE NOTICES.

The posting of warning notices along trails or other places where people pass, on the main roads, and at public meeting places is a very important part of fire protection and has been practiced with much success both on the National and State forests, and also in many cases on private forest properties. A notice will generally attract the attention of the passerby, and, if it is short and in good type, will generally be read by him. Such a notice is calculated to make a man more careful when he would otherwise not think of the danger from fire. The majority of fires in this State result from carelessness and not from malice. If, therefore, a notice is read, reminding the passerby of the danger of fire and the injury resulting from it, in many cases the fire would be prevented. Notices may be of several kinds, to deal with the several different classes of people, and where one landowner would find one kind efficient, another owner in another locality might find a different kind of more use.

Where the owner resides on the property and is on good terms with the neighbors, a gentle reminder will often be much more efficacious than a legal warning. The following notice is suggested:

NOTICE!

THE OWNERS OF THIS LAND ARE VERY ANXIOUS TO KEEP

FIRE

OUT OF THE WOODS AT ALL SEASONS OF THE YEAR. THEY ARE, THEREFORE, ASKING THE ACTIVE CO-OPERATION OF ALL NEIGHBORS WHO ADJOIN THIS PROPERTY AND ALL PERSONS WHO PASS OVER OR USE THIS LAND FOR ANY PURPOSE WHATSOEVER. SUCH PERSONS ARE REQUESTED TO BE VERY CAREFUL ABOUT THROWING DOWN LIGHTED MATCHES, CIGAR OR CIGARETTE STUMPS OR ASHES FROM THEIR PIPES; TO MAKE NO CAMP-FIRES AGAINST LARGE LOGS OR DEAD STANDING OR DOWN TREES; TO BE VERY CAREFUL TO EXTINGUISH ALL CAMP-FIRES BEFORE LEAVING THEM; AND TO DO THEIR BEST TO EXTINGUISH ANY FOREST FIRE THAT THEY MAY DISCOVER.

If, on the other hand, the people of the neighborhood do not understand the reasons for fire protection, and it is thought that they are not conversant with the laws on this subject, a fire notice like the following may have the most effect:

LOOK OUT FOR FOREST

FIRE

DO NOT BURN THE WOODS. IT CAUSES THE DESTRUCTION OF MUCH TIMBER, ESPECIALLY YOUNG TIMBER, AS WELL AS OTHER PROPERTY.

LAWS OF STATE OF NORTH CAROLINA (Section 3346 of Revisal).

If any person shall set fire to any woods, except it be his own property, or, in that case, without first giving notice in writing to all persons owning land adjoining to the woodland intended to be fired at least two days before the time of firing such woods, and also taking effectual care to extinguish such fire before it shall reach any public or private lands near to or adjoining the land so fired, *he shall for every such offense forfeit and pay* to any person who shall sue for the same *fifty dollars* and be liable to any one injured in an action, *and shall, moreover, be guilty of a misdemeanor.*

If, again, there is a certain lawless element in the neighborhood, and it is thought that fires are being set on purpose, a sharply worded warning to the effect that the owner was on the lookout and would prosecute any one caught setting fire, to the full extent of the law, might be the best form of notice.

A clause against burning the woods should in all cases be combined with the ordinary form of trespass notice which is now coming into such common use. It is certainly as important to warn trespassers against setting fires as it is to forbid them to camp or to range stock. A trespass notice might read somewhat as follows:

NOTICE!

ALL PERSONS ARE HEREBY FORBIDDEN TO TRESPASS ON THIS LAND, EITHER BY HUNTING, FISHING, CUTTING TIMBER, **FIRING THE WOODS**, CAMPING OR RANGING STOCK OF ANY KIND, UNDER PENALTY OF THE LAW.

[SIGNED] **JOHN DOE.**

Any of the above notices can be printed on heavy cloth by local printers at prices ranging from 65 cents a dozen and $2.50 a hundred to twice that price. The most convenient sizes are 9 x 12 inches or 12 x 18 inches.

EXTINGUISHING FIRES.

Most people who live in or near the woods have some idea of how to fight a fire, but a few suggestions may be helpful to some readers. When no wind is blowing, an ordinary grass or leaf fire can generally be extinguished by beating with green brush, pine tops, laurel, or ivy bushes, canes, or other tough and dense brush, or with a wet sack. If, however, the wind is blowing, such a fire cannot be attacked directly in front. The best way is to work on the rear and side lines of the fire and gradually, as opportunity offers, crowd it in, so that the front gets gradually narrower and narrower. Then, by taking advantage of any change in the wind, or of a stream or ridge top, the front of the fire may finally be stopped. The best time to fight a fire is at night, when the wind is less likely to be blowing and when the leaves get somewhat damp with dew. Where a fire is too hot to get to it to beat it out, the leaves can be raked away from it, so that a fire line is really made in front of the fire at which the fire will naturally stop when it finds no more to feed on. In fairly level country, as in the pine region of the East, good work against a fire can often be done with a plow, one furrow frequently being sufficient to stop a ground fire when there is not much wind. Where a wagon can drive through the woods and get close to the fire, chemical extinguishers have been used to good advantage, the contents of one extinguisher effectually putting out from 50 to 100 yards of fire. In the northern forests a hose from a train or a pump on a wagon has been used very successfully, and this method could probably be used to good advantage in this State by railroads and the larger lumber companies. In some cases when fires get beyond control and there is no chance of a fighting force getting near enough to put it out, back firing has to be resorted to. This means setting a fire in front of an advancing fire and allowing it to burn back against the wind and towards the large fire, without letting it advance with the wind. Such a method should be resorted to only in exceptional cases, when no other method seems available, and it should be done with the greatest care, for a back fire getting beyond control only adds to the destructiveness of the original fire.

The principal thing in extinguishing fires is to begin at once. A small fire is easily controlled and quickly put out, but a few hours' delay may mean a large, unmanageable fire which will destroy much property and cost a lot of time and money before it can be brought under control.

CONCLUSION.

According to 158 correspondents, reporting from 84 counties of the State, something over 400,000 acres of forest land were burned over in North Carolina during the year 1909. It is estimated that, with counties not heard from, many townships entirely unreported, and fires overlooked by correspondents, this total should be increased by at least 50 per cent. At this rate, over 5 per cent of the estimated total area of forest land in North Carolina was burned over in 1909.

The damage, as estimated by correspondents, amounted to over $260,000, or about 66 cents per acre burned. This direct loss of 66 cents does not include damage to living timber, to young growth, to soil and streams, which certainly amounts to more than as much again. This loss of $1 to $1.30 per acre is in large part preventable. Forest fires are caused chiefly by carelessness, less than 25 per cent of the correspondents attributing them to incendiary origin. To overcome this careless attitude on the part of the people, and induce both private effort and State coöperation in the fight against forest fires, public opinion on this subject must be awakened. With the general application of the stock law over the State, the passage of some progressive laws by the Legislature, and the hearty coöperation of the counties and townships and of the railroads, supported by a strong public sentiment against fire, this loss of from one-half to three-quarters of a million dollars a year to our people from forest fires will rapidly be reduced to a minimum.

PUBLICATIONS

OF THE

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

BULLETINS.

1. Iron Ores of North Carolina, by Henry B. C. Nitze, 1893. 8°, 239 pp., 20 pl., and map. *Postage 10 cents.*

2. Building and Ornamental Stones in North Carolina, by T. L. Watson and F. B. Laney in collaboration with George P. Merrill, 1906. 8°, 283 pp., 32 pl., 2 figs. *Postage 25 cents. Cloth-bound copy 30 cents extra.*

3. Gold Deposits in North Carolina, by Henry B. C. Nitze and George B. Hanna, 1896. 8°, 196 pp., 14 pl., and map. *Out of print.*

4. Road Material and Road Construction in North Carolina, by J. A. Holmes and William Cain, 1893. 8°, 88 pp. *Out of print.*

5. The Forests, Forest Lands and Forest Products of Eastern North Carolina, by W. W. Ashe, 1894. 8°, 128 pp., 5 pl. *Postage 5 cents.*

6. The Timber Trees of North Carolina, by Gifford Pinchot and W. W. Ashe, 1897. 8°, 227 pp., 22 pl. *Postage 10 cents.*

7. Forest Fires: Their Destructive Work, Causes and Prevention, by W. W. Ashe, 1895. 8°, 66 pp., 1 pl. *Postage 5 cents.*

8. Water-powers in North Carolina, by George F. Swain, Joseph A. Holmes and E. W. Myers, 1899. 8°, 362 pp., 16 pl. *Postage 16 cents.*

9. Monazite and Monazite Deposits in North Carolina, by Henry B. C. Nitze, 1895. 8°, 47 pp., 5 pl. *Postage 4 cents.*

10. Gold Mining in North Carolina and other Appalachian States, by Henry B. C. Nitze and A. J. Wilkins, 1897. 8°, 164 pp., 10 pl. *Postage 10 cents.*

11. Corundum and the Basic Magnesian Rocks of Western North Carolina, by J. Volney Lewis, 1895. 8°, 107 pp., 6 pl. *Postage 4 cents.*

12. History of the Gems Found in North Carolina, by George Frederick Kunz, 1907. 8°, 60 pp., 15 pl. *Postage 8 cents. Cloth-bound copy 30 cents extra.*

13. Clay Deposits and Clay Industries in North Carolina, by Heinrich Ries, 1897. 8°, 157 pp., 12 pl. *Postage 10 cents.*

14. The Cultivation of the Diamond-back Terrapin, by R. E. Coker, 1906. 8°, 67 pp., 23 pl., 2 figs. *Postage 6 cents.*

15. Experiments in Oyster Culture in Pamlico Sound, North Carolina, by Robert E. Coker, 1907. 8°, 74 pp., 17 pl., 11 figs. *Postage 6 cents.*

16. Shade Trees for North Carolina, by W. W. Ashe, 1908. 8°, 74 pp., 10 pl., 16 figs. *Postage 6 cents.*

17. Terracing of Farm Lands, by W. W. Ashe, 1908. 8°, 38 pp., 6 pl., 2 figs. *Postage 4 cents.*

18. Bibliography of North Carolina Geology, Mineralogy and Geography, with a list of Maps, by Francis Baker Laney and Katherine Hill Wood, 1909. 8°, 428 pp. *Postage 25 cents.*

19. The Tin Deposits of the Carolinas, by Joseph Hyde Pratt and Douglass B. Sterrett, 1905. 8°, 64 pp., 8 figs. *Postage 4 cents.*

20. Water-powers of North Carolina: An Appendix to Bulletin 8. *In Press.*

21. The Gold Hill Mining District of North Carolina, by Francis Baker Laney, 1910. 8°, 137 pp., 23 pl., 5 figs. *Postage 15 cents.*

22. A Report on the Cid Mining District, by J. E. Pogue, Jr. *In Press.*

ECONOMIC PAPERS.

1. The Maple-Sugar Industry in Western North Carolina, by W. W. Ashe, 1897. 8°, 34 pp. *Postage 2 cents.*

2. Recent Road Legislation in North Carolina, by J. A. Holmes. *Out of print.*

3. Talc and Pyrophyllite Deposits in North Carolina, by Joseph Hyde Pratt, 1900. 8°, 29 pp., 2 maps. *Postage 2 cents.*

4. The Mining Industry in North Carolina During 1900, by Joseph Hyde Pratt, 1901. 8°, 36 pp., and map. *Postage 2 cents.*

Takes up in some detail Occurrences of Gold, Silver, Lead and Zinc, Copper, Iron, Manganese, Corundum, Granite, Mica, Talc, Pyrophyllite, Graphite, Kaolin, Gem Minerals, Monazite, Tungsten, Building Stones, and Coal in North Carolina.

5. Road Laws of North Carolina, by J. A. Holmes. *Out of print.*

6. The Mining Industry in North Carolina During 1901, by Joseph Hyde Pratt, 1902. 8°, 102 pp. *Postage 4 cents.*

Gives a List of Minerals found in North Carolina; describes the Treatment of Sulphuret Gold Ores, giving Localities; takes up the Occurrence of Copper in the Virgilina, Gold Hill, and Ore Knob districts; gives Occurrence and Uses of Corundum; a List of Garnets, describing Localities; the Occurrence, Associated Minerals, Uses and Localities of Mica; the Occurrence of North Carolina Feldspar, with Analyses; an extended description of North Carolina Gems and Gem Minerals; Occurrences of Monazite, Barytes, Ocher; describes and gives Occurrences of Graphite and Coal; describes and gives Occurrences of Building Stones, including Limestone; describes and gives Uses for the various forms of Clay; and under the head of "Other Economic Minerals" describes and gives Occurrences of Chromite, Asbestos, and Zircon.

7. Mining Industry in North Carolina During 1902, by Joseph Hyde Pratt, 1903. 8°, 27 pp. *Postage 2 cents.*

8. The Mining Industry in North Carolina During 1903, by Joseph Hyde Pratt, 1904. 8°, 74 pp. *Postage 4 cents.*

Gives descriptions of Mines worked for Gold in 1903; descriptions of Properties worked for Copper during 1903, together with assay of ore from Twin-Edwards Mine; Analyses of Limonite ore from Wilson Mine; the Occurrence of Tin; in some detail the Occurrences of Abrasives; Occurrences of Monazite and Zircon; Occurrences and Varieties of Graphite, giving Methods of Cleaning; Occurrences of Marble and other forms of Limestone; Analyses of Kaolin from Barber Creek, Jackson County, North Carolina.

9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

Gives Mines Producing Gold and Silver during 1903 and 1904 and Sources of the Gold Produced during 1904; describes the mineral Chromite, giving Analyses of Selected Samples of Chromite from Mines in Yancey County; describes Commercial

Varieties of Mica, giving the manner in which it occurs in North Carolina, Percentage of Mica in the Dikes, Methods of Mining, Associated Minerals, Localities, Uses; describes the mineral Barytes, giving Method of Cleaning and Preparing Barytes for Market; describes the use of Monazite as used in connection with the Preparation of the Bunsen Burner, and goes into the use of Zircon in connection with the Nernst Lamp, giving a List of the Principal Yttrium Minerals; describes the minerals containing Corundum Gems, Hiddenite and Other Gem Minerals, and gives New Occurrences of these Gems; describes the mineral Graphite and gives new Uses for same.

10. Oyster Culture in North Carolina, by Robert E. Coker, 1905. 8°, 39 pp. *Postage 2 cents.*

11. The Mining Industry in North Carolina During 1905, by Joseph Hyde Pratt, 1906. 8°, 95 pp. *Postage 4 cents.*

Describes the mineral Cobalt and the principal minerals that contain Cobalt; Corundum Localities; Monazite and Zircon in considerable detail, giving Analyses of Thorianite; describes Tantalum Minerals and gives description of the Tantalum Lamp; gives brief description of Peat Deposits; the manufacture of Sand-lime Brick; Operations of Concentrating Plant in Black Sand Investigations; gives Laws Relating to Mines, Coal Mines, Mining, Mineral Interest in Land, Phosphate Rock, Marl Beds.

12. Investigations Relative to the Shad Fisheries of North Carolina, by John N. Cobb, 1906. 8°, 74 pp., 8 maps. *Postage 6 cents.*

13. Report of Committee on Fisheries in North Carolina. Compiled by Joseph Hyde Pratt, 1906. 8°, 78 pp. *Postage 4 cents.*

14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

Under the head of "Recent Changes in Gold Mining in North Carolina," gives methods of mining, describing Log Washers, Square Sets, Cyanide Plants, etc., and detailed descriptions of Gold Deposits and Mines are given; Copper Deposits of Swain County are described; Mica Deposits of Western North Carolina are described, giving Distribution and General Character, General Geology, Occurrence, Associated Minerals, Mining and Treatment of Mica, Origin, together with a description of many of the mines; Monazite is taken up in considerable detail as to Location and Occurrence, Geology, including Classes of Rocks, Age, Associations, Weathering, method of Mining and Cleaning, description of Monazite in Original Matrix.

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt, 1908. 8°, 176 pp., 13 pl., and 4 figs. *Postage 15 cents.*

Takes up in detail the Copper of the Gold Hill Copper District; a description of the Uses of Monazite and its Associated Minerals; descriptions of Ruby, Emerald, Beryl, Hiddenite, and Amethyst Localities; a detailed description with Analyses of the Principal Mineral Springs of North Carolina; a description of the Peat Formations in North Carolina, together with a detailed account of the Uses of Peat and the Results of an Experiment Conducted by the United States Geological Survey on Peat from Elizabeth City, North Carolina.

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina, compiled by Joseph Hyde Pratt, State Geologist, 1908. 8°, 45 pp. *Postage 4 cents.*

17. Proceedings of Drainage Convention held at New Bern, North Carolina, September 9, 1908. Compiled by Joseph Hyde Pratt, 1908. 8°, 94 pp. *Postage 5 cents.*

18. Proceedings of Second Annual Drainage Convention held at New Bern, North Carolina, November 11 and 12, 1909, compiled by Joseph Hyde Pratt, and containing North Carolina Drainage Law, 1909. 8°, 50 pp. *Postage 3 cents.*

19. Forest Fires in North Carolina During 1909, by J. S. Holmes, Forester, 1910. 8°, 52 pp., pl. *Postage 3 cents.*

VOLUMES.

Vol. I. Corundum and the Basic Magnesian Rocks in Western North Carolina, by Joseph Hyde Pratt and J. Volney Lewis, 1905. 8°, 464 pp., 44 pl., 35 figs. *Postage 32 cents. Cloth-bound copy 30 cents extra.*

Vol. II. Fishes of North Carolina, by H. M. Smith, 1907. 8°, 453 pp., 21 pl., 188 figs. *Postage 30 cents.*

Vol. III. The Physiography and Geography of the Coastal Plain Region of North Carolina. *In Press.*

Samples of any mineral found in the State may be sent to the office of the Geological and Economic Survey for identification, and the same will be classified free of charge. It must be understood, however, that NO ASSAYS, OR QUANTITATIVE DETERMINATIONS, WILL BE MADE. Samples should be in a lump form if possible, and marked plainly on outside of package with name of sender, post-office address, etc.; a *letter* should accompany sample and *stamp* should be enclosed for reply.

These publications are mailed to libraries and to individuals who may desire information on any of the special subjects named, free of charge, except that in each case applicants for the reports should forward the amount of *postage* needed, as indicated above, for mailing the bulletins desired, to the *State Geologist, Chapel Hill, N. C.*

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, State Geologist

ECONOMIC PAPER No. 20

WOOD-USING INDUSTRIES OF NORTH CAROLINA

BY

ROGER E. SIMMONS

UNDER THE DIRECTION OF

J. S. HOLMES AND H. S. SACKETT

MAY 20, 1775

RALEIGH
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS
1910

557
N813e
20

GEOLOGICAL BOARD.

Governor W. W. Kitchin, *ex officio Chairman*	Raleigh.
Frank R. Hewitt	Asheville.
Hugh MacRae	Wilmington.
C. S. Vann	Edenton.
R. D. Caldwell	Lumberton.
Joseph Hyde Pratt, *State Geologist*	Chapel Hill.

LETTER OF TRANSMITTAL.

CHAPEL HILL, N. C., July 1, 1910.

To His Excellency, HON. W. W. KITCHIN,
Governor of North Carolina.

SIR:—There has just been prepared a report on the Wood-using Industries of North Carolina, which has been compiled by Mr. Roger E. Simmons. This report has been prepared jointly by the North Carolina Geological and Economic Survey and the U. S. Forest Service, and I would recommend that this be published as Economic Paper No. 20 of the reports of the Survey. This report should be of considerable value to the State of North Carolina in forming a forest policy which, if worked out along certain lines, will insure a permanent supply of raw material for our wood-using industries. The report will also be of interest and value to the timber owner, the sawmill operator, and the manufacturers and merchants who handle the finished products.

Yours respectfully,
JOSEPH HYDE PRATT,
State Geologist.

CONTENTS.

PAGE.
Introductory statement by Joseph Hyde Pratt, State Geologist.......... 7
Wood-using industries of North Carolina.......... 11
  Introduction.......... 11
Kinds of woods used.......... 11
  Home-grown woods used in North Carolina.......... 13
  Woods grown outside of North Carolina.......... 15
Industries utilizing wood.......... 17
  Consumption by industries in regions.......... 20
  Form, grade, and sizes of raw material.......... 22
  Flooring, ceiling, siding, etc.......... 25
  Furniture.......... 27
  Boxes and crates.......... 30
  Sash, doors, blinds, etc.......... 32
  Chairs.......... 34
  Tables.......... 36
  Vehicles.......... 38
  Fruit and vegetable packages.......... 40
  Insulator pins and brackets.......... 42
  Coffins, caskets, and casket cases.......... 42
  Handles.......... 44
  Shuttles, spools, bobbins, etc.......... 44
  Farming implements.......... 45
  Kitchen safes.......... 46
  Cross-arms.......... 46
  Pipes, mine rollers, and pulleys.......... 47
  Store and office fixtures, mantels, etc.......... 48
  Musical instruments.......... 50
  Planking for boats.......... 52
  Excelsior.......... 52
  Woodenware.......... 53

APPENDIX I:

  Uses of different kinds of woods (list).......... 55

APPENDIX II:

  List of wood manufacturers.......... 61

LIST OF ILLUSTRATIONS.

PLATE *Facing Page*
I. Bird's-eye view of the furniture district of High Point, N. C. "The Grand Rapids of the South" ... 11
II. Mill and yard of Goldsboro Lumber Company, Dover, N. C., manufacturers of high-class flooring, ceiling, siding and molding. The pine logs in the foreground are ready to be sawed ... 22
III. Main floor of the factory of the Southern Chair Company, High Point, N. C. ... 28
IV. Turning-room of Southern Chair Company, High Point, N. C. ... 34
V. *A*, Interior view of wheel factory of High Point Buggy Company, High Point, N. C. *B*, Interior view of packing department of High Point Buggy Company, High Point, N. C. ... 38
VI. Mill and yard of the Wilkes Veneer Company, Edenton, N. C. ... 40

INTRODUCTORY STATEMENT.

By JOSEPH HYDE PRATT, State Geologist.

The present report deals with the wood-using industries of North Carolina. These may be divided into three classes: (1) those taking timber in the log and by the usual operation of the sawmill converting it into rough lumber; (2) those manufacturing directly from the log a finished product which cannot be changed by any further process of manufacture, such as staves, excelsior, shingles, veneer boxes, or mine rollers; and (3) those using rough lumber and by application of skilled labor and the aid of wood-using machinery converting it into such finished products as furniture, boxes, flooring, etc.

The wood-using industries which come under the first class are not included in this study. Information covering that class is published annually in a statistical report by the Bureau of Census in coöperation with the United States Forest Service, which gives the lumber cut for the country by States and species. The second and third classes, or those industries producing a commodity which cannot be changed by further manufacture, are discussed in this report, and information regarding them has been collected from all sources available. This information has never, heretofore, been made a subject of special investigation in North Carolina. The new forms which further manufacture gives to lumber, and the commodities into which wood enters, are worthy of careful study. The tables given in this report show the sources of such wood used, whether grown in North Carolina or in States nearby or far distant, the kinds of lumber demanded by the woodworking factories, the price paid for each species delivered, the quantity consumed, and the purposes for which it was used.

An investigation of this character should be of value in a number of ways. To the State of North Carolina it should be of considerable assistance in forming an intelligent forest policy, and in presenting the advantages the State offers to wood-using industries to locate in it. The timber owner, and even the farmer who has a few scattered trees to sell, can learn from this report where a market can be found. To the sawmill operator it may suggest a use for wood which he previously considered of little commercial value. To the manufacturer who is under the necessity of looking beyond his own State for all, or part, of the lumber needed, it will furnish a source of fairly accurate information concerning a region most likely to supply his needs. The merchants throughout the country who handle wood products can study to advantage the report of what North Carolina has to sell, or wishes to buy. For the people at large it has a statistical value, and gives much general information.

It gives valuable information concerning the forms, uses, and grades in which the factories desire the lumber, and also the woods most suitable for particular purposes. The chief purposes of this report are to give needed information regarding these industries, to stimulate trade by bringing together buyer and seller, and to show the citizens of North Carolina the wisdom of perpetuating her valuable wood-using industries by the adoption of an intelligent forest policy. Two appendices have been added to this report. The first gives a list of the different kinds of woods that are found in North Carolina, together with the various purposes for which they are used, and the second appendix gives a list of the wood manufacturers of North Carolina under the heads of the products which they manufacture.

The information contained in this report was gathered in the fall of 1909 by the Forest Service of the United States Department of Agriculture and the Forestry Division of the North Carolina Geological and Economic Survey, and these two departments desire to express their thanks to the manufacturers supplying this information, and especially to those who have answered requests for information by mail. The report has been compiled by Mr. Roger E. Simmons, under the supervision of Mr. J. S. Holmes, Forester of the North Carolina Geological and Economic Survey, and Mr. H. S. Sackett of the United States Forest Service.

The value of the timber crop in North Carolina is exceeded only by that of the cotton and corn crops. According to the United States Census Bureau, the value of the lumber-cut of this State amounted in 1908 to $15,000,000.

The following report shows that half of this lumber was purchased by firms in this State and manufactured by them into a finished product. For this lumber, together with a small amount of logs, billets, and timber in other forms which they used, these firms paid something over $10,000,000.

This enormous industry has been dependent for its supply of raw material almost entirely on timber that has grown up under natural conditions, the present owners being in no way responsible or assisting in its production, much of the timber having been growing for 200 to 300 years. As this old timber disappears, as it is rapidly doing, the methods of the producers will have to change, or else one of two things must happen: either this timber will have to be procured outside the State or these large and valuable industries, second only in importance to cotton manufacture, will have to shut down.

As long as both the growing and the manufacture of this timber can be carried on profitably in this State, we cannot afford to give up either part of this twofold industry. North Carolina probably contains as large a proportion of mountain land specially suitable for the growth of hardwoods, which is what most of these industries require, as any other State. We can, therefore, grow the raw material more cheaply, and furnish it to these factories at a lower price.

This report is intended as an incentive to improvement and as an aid in bringing about better conditions, partly in demonstrating the value of our forests to the people of the State, but chiefly by enlarging the market for the lower grades of wood by letting other parts of the country know what North Carolina can furnish them.

By protecting the forests from fire so that the annual rate of growth can be continually increasing, and by closer utilization, thus preventing waste in the woods and at the mill, there is no reason why the annual yield of our forests cannot after a comparatively short time be doubled.

If as much care and foresight were exercised in the growing, protection, harvesting, and marketing of the raw material as is now given to the manufacture of the finished product, there need be no fear of an impending timber famine on the part of the wood-using industries of North Carolina.

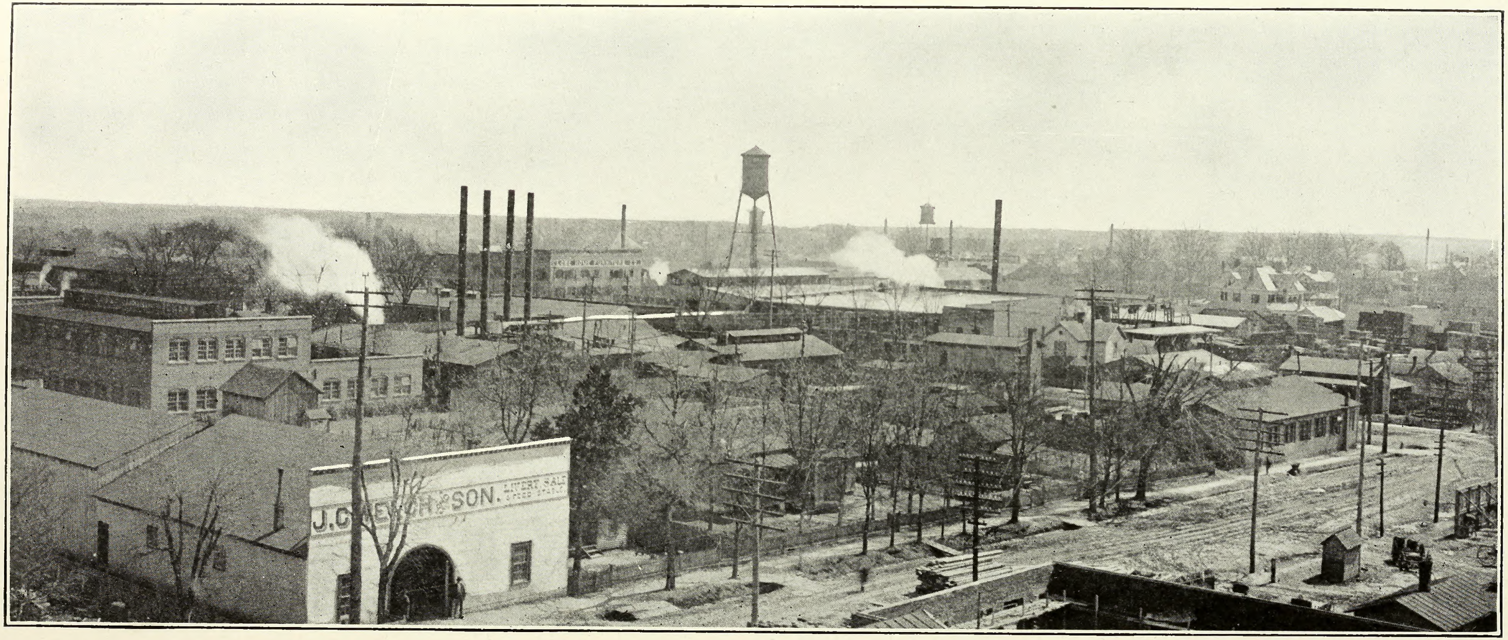


Plate I. Bird's-eye view in the furniture district of High Point, N. C. The "Grand Rapids of the South."

WOOD-USING INDUSTRIES OF NORTH CAROLINA.

BY

ROGER E. SIMMONS, UNDER THE DIRECTION OF J. S. HOLMES AND H. S. SACKETT.

INTRODUCTION.

For many years North Carolina has been one of the leading lumber-producing States. Its cut in 1908 exceeded one billion board feet, an amount equaled by only thirteen States. It not only produces a large quantity of rough lumber, but its rating is very high as a manufacturer of finished products. Though there are no means of definitely determining the relative importance of this State among the leading wood-manufacturing States, it is safe to say that few surpass North Carolina in the total amount of the raw material annually consumed in manufacture. It is probable that in no other State in the Union is there so large a percentage of home-grown raw material put into the products of its manufacture. There is converted annually into these products 676,000,000 feet, of which 96 per cent is produced in the State. This amount of material used by the woodworking industries does not include rough lumber in the form of boards, planks, scantling, and structural timber, as these go largely into buildings or other structural work in their rough form. Neither are cross-ties, veneer, cooperage stock, shingles, telegraph and telephone poles included. These are accounted for in special statistics issued annually by the Bureau of the Census, as explained in another part of this report.

KINDS OF WOODS USED.

Thirty-two species of wood, with the amount used and the cost of each at the factory, are presented in Table 1. Where several species of the same genus are all equally suitable for the purpose desired, it was often impossible to get information upon them separately. For instance, white, red, Spanish, and chestnut oak are all acceptable to the furniture manufacturer as raw material. When purchased from local mills, as much of this material is, it was received as "oak," without specifying the particular kinds. In the tables giving information in summary form the general terms of oak, ash, gum, etc., are employed, while in the tables dealing with the individual industries, the exact species are given as reported.

Notwithstanding the heavy drain made for many years on the yellow-pine forests of North Carolina, depleting to a large extent the virgin growth, the amount of this kind of wood consumed by the manufacturers takes the lead over all others. Of the total quantity of yellow-pine lumber produced in 1908 in this State, according to figures annually compiled, 50 per cent was converted into finished form ready for the consumer. Yellow pine stands first in Table 1 with 62 per cent of the total quantity of all kinds of woods manufactured, followed by oak with 21 per cent, poplar 5.3 per cent, gum 3.2 per cent, white pine 2 per cent, and the other twenty-six species in decreasing amounts. This table shows what percentage of the total quantity grown in and out of the State was supplied by each species. It is interesting to note that of the thirty-two species reported, North Carolina furnished all, or a large part of all, but two. The two foreign woods are mahogany and Circassian walnut. This emphasizes how very important the home supply of lumber is to the people of North Carolina, only 4 per cent coming from outside.

TABLE 1.—SUMMARY OF THE ANNUAL CONSUMPTION OF RAW MATERIAL GROWN IN AND OUTSIDE OF NORTH CAROLINA.

KIND OF WOOD.	Total Quantity Feet b. m.	Total Cost Delivered at Factory.	SOURCE OF RAW MATERIAL.	
			North Carolina, Per cent.	Outside of North Carolina, Per cent.
Yellow pine	421,706,000	$5,122,346.65	98.3	1.7
Oak	145,059,000	2,666,669.95	96.6	3.4
Yellow poplar	35,263,000	645,214.95	77.0	23.0
Gum	26,873,000	250,426.41	98.9	1.1
White pine	13,115,000	207,230.28	100.0	----------
Hickory	11,025,000	273,971.30	53.3	46.7
Chestnut	7,761,000	127,617.80	96.1	3.9
Maple	4,110,000	64,739.80	98.9	1.1
Cypress	2,865,000	41,850.00	97.7	2.3
Locust	2,600,000	36,400.00	100.0	----------
Ash	1,417,000	36,350.12	99.3	.7
White cedar	1,050,000	16,504.00	100.0	----------
Dogwood	600,000	11,250.00	100.0	----------
Black walnut	591,000	24,330.00	30.6	69.4
Birch	513,000	14,147.95	88.9	11.1
Sycamore	369,000	4,110.12	95.9	4.1
Basswood (linn)	265,000	5,500.00	100.0	----------
Elm	197,000	2,610.00	100.0	----------
Beech	155,000	3,059.75	100.0	----------
Persimmon	150,000	3,000.00	100.0	----------
Spruce	150,000	1,875.00	100.0	----------
Red cedar	145,000	3,925.00	100.0	----------
Mahogany	64,250	9,555.29	----------	100.0
Cottonwood	30,000	360.00	100.0	----------
Cherry	29,000	1,398.00	100.0	----------
Hemlock	25,000	300.00	100.0	----------
Kalmia (mountain laurel)	22,000	220.00	100.0	----------
Butternut (white walnut)	20,000	800.00	100.0	----------
Cucumber	15,000	180.00	100.0	----------
Buckeye	10,000	400.00	100.0	----------
Box elder (Silverbell)	5,000	60.00	100.0	----------
Circassian walnut	3,000	600.00	----------	100.0
All others*	3,000	240.00	----------	100.0
Totals	676,166,250	9,577,242.37	96.0	4.0

*Includes imported woods not mentioned.

Eighteen of the woods demanded by the various industries are grown entirely in the State. In the case of eight others, 90 per cent is home-grown, while for only one American species is as much as 50 per cent obtained from other States.

HOME-GROWN WOODS USED IN NORTH CAROLINA.

The characteristic growth of the timber, as well as the surface, soil, and other natural conditions, divide the State of North Carolina into three well-known regions, the Coastal Plain, the Piedmont region, and the Mountain region. Table 2 gives the amount in feet consumed in the three regions. Only State-grown wood is considered in this table. The total used by the manufacturers in these regions represents all of the timber grown in North Carolina which goes into finished products. The prices paid for lumber used in these sections, as well as the average price for each kind of wood grown in this State, are likewise shown.

The Coastal Plain region takes approximately 63 per cent of the yellow pine, while the Piedmont region uses only 36 per cent, and the Mountain region 1 per cent. Ninety per cent of the 140,000,000 feet of oak used in the State is manufactured in the Piedmont region; 72 per cent of the gum in the Coastal Plain, and none in the Mountain region; while the Mountain region manufactures most of the spruce and basswood, and uses a greater number of kinds than either of the other regions. The manufacturers in the State use a total of 650,153,000 feet a year of this home-grown material at an average cost per M of $14.13. Of this amount, the Piedmont region takes 53 per cent, the Coastal Plain 44 per cent, and the Mountain region 3 per cent.

It is of as much interest to compare the prices paid in each of the three regions as it is the quantities of material used. Where a wood is indigenous to one region and not to the others, its price is expected to be lower in that region, especially if large amounts of all grades are manufactured. An exception, however, is noted in the case of ash in the Mountain region where it is most abundant, and its price is higher than in the other regions. This difference in price is probably owing to the fact that manufacturers in the different regions demand different grades of this lumber.

TABLE 2.—SUMMARY OF THE ANNUAL CONSUMPTION OF WOODS GROWN IN NORTH CAROLINA.

Kind of Wood.	Coastal Plain Region.		Piedmont Region.		Mountain Region.		State of North Carolina.	
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.
Yellow pine	260,262,000	$ 11.94	151,218,000	$ 12.40	3,601,000	$ 15.66	415,081,000	$ 12.14
Oak	1,437,000	19.80	133,933,000	18.31	4,808,000	10.26	140,178,000	18.05
Yellow poplar	4,372,000	17.03	22,284,000	17.75	499,000	16.33	27,155,000	17.61
Gum	19,895,000	8.14	6,678,000	12.09			26,573,000	9.14
White pine	10,000	27.50	12,565,000	15.67	540,000	18.52	13,115,000	15.80
Chestnut	500,000	19.00	6,061,000	16.31	900,000	16.41	7,461,000	16.50
Hickory	160,000	38.25	4,245,000	24.43	1,475,000	10.40	5,880,000	21.28
Maple	650,000	9.60	3,310,000	17.09	105,000	19.29	4,065,000	15.95
Cypress	2,750,000	13.67					2,750,000	13.67
Locust			2,000,000	14.00	600,000	14.00	2,600,000	14.00
Ash	359,000	23.02	993,000	26.33	55,000	30.00	1,407,000	25.62
White cedar	1,050,000	15.72					1,050,000	15.72
Dogwood			450,000	20.00	150,000	15.00	600,000	18.75
Birch			356,000	28.06	102,000	22.04	458,000	26.72
Sycamore	50,000	7.00	304,000	11.38			354,000	10.76
Basswood (linn)			65,000	32.31	200,000	17.00	265,000	20.75
Elm	175,000	12.75	22,000	18.64			197,000	13.38
Black walnut	40,000	32.00	121,000	44.21	20,000	50.00	181,000	42.15
Beech	135,000	16.74	20,000	40.00			155,000	19.74
Persimmon			150,000	20.00			150,000	20.00
Spruce					150,000	18.75	150,000	18.75
Red cedar			145,000	27.08			145,000	27.08
Cottonwood					30,000	12.00	30,000	12.00
Cherry			2,000	24.00	27,000	48.07	29,000	46.41
Hemlock					25,000	12.00	25,000	12.00
Kalmia (mountain laurel)					22,000	10.00	22,000	10.00
Butternut (white walnut)					20,000	40.00	20,000	40.00
Cucumber					15,000	12.00	15,000	12.00
Buckeye					10,000	40.00	10,000	40.00
Box elder (silverbell)					5,000	12.00	5,000	12.00
Totals	291,845,000		344,947,000		13,359,000		650,151,000	13.83

WOODS GROWN OUTSIDE OF NORTH CAROLINA.

Table 2 treats of the raw material grown in North Carolina, while Table 3 deals with the lumber grown outside of the State. This table gives the quantity of wood used in manufacture, the average cost, delivered at the factory, and the percentage of the different species shipped into the State, grown in the several States mentioned.

The woods brought from outside of the State in 1909 for the wood-using industries aggregated 26,000,000 feet. It is of interest to note that 93 per cent of this quantity is grown in States contiguous to North Carolina. Tennessee ranks first, furnishing 51 per cent; South Carolina, Virginia, and Kentucky follow in the order named, supplying 20, 16, and 6 per cent, respectively. The imported woods amount to little over one-quarter of one per cent of the total. The average price paid for all home-grown material, as shown in Table 2, was $14.13. Table 3, which follows, gives the average cost at the factory of the woods brought from a distance at $26.29, making a difference of $12.16 per M feet in the cost of the woods grown in and out of the State.

A greater quantity of yellow poplar is shipped into North Carolina than any other wood used by the manufacturers. The 8,068,000 feet grown in other States, as shown in the table, is 23 per cent of the total quantity of poplar used. North Carolina pine, following next in the quantity of wood grown outside of the State, is 6,625,000 feet. Two-thirds of this amount is brought from South Carolina, while the remainder is grown in Virginia and Georgia. Sixty-nine per cent of the black walnut used is shipped into the State, and 43 per cent of the hickory. No other wood comes up to these in the relative quantity shipped in. Tennessee and Kentucky furnished most of the hickory.

TABLE 3.—SUMMARY OF THE ANNUAL CONSUMPTION OF WOODS GROWN OUTSIDE OF NORTH CAROLINA.

KIND OF WOOD.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	PERCENTAGE DISTRIBUTION BY STATES.						
			Tennessee.	South Carolina.	Virginia.	Kentucky.	Georgia.	Various States.	Imported.
Yellow poplar	8,068,000	$ 21.26	84.2	5.0	8.1	1.2	1.5		
North Carolina pine	6,625,000	12.80		66.0	31.0		3.0		
Hickory	5,145,000	28.93	65.2		1.3	19.9		13.6	
Red and white oak	4,881,000	27.90	59.1		25.4	8.6	6.7	.2	
Black walnut	410,000	40.73						100.0	
Chestnut	300,000	15.00	66.7		33.3				
Red and tupelo gum	300,000	25.00		100.0					
Cypress	115,000	36.96		100.0					
Mahogany	64,250	147.42							100.0
Birch	55,000	34.73					100.0		
Maple	45,000	33.33	17.8					82.2	
Sycamore	15,000	20.00			100.0				
Ash	10,000	30.00	100.0						
Circassian walnut	3,000	200.00							100.0
All others*	3,000	80.00						33.3	66.7
Totals	26,014,250	26.29	50.9	20.0	15.9	5.9	2.5	4.5	.3

*Includes only imported woods not mentioned.

INDUSTRIES UTILIZING WOOD.

An industry, as it is considered in this report, embraces all manufacturing concerns which produce commodities that are similar or closely related. In North Carolina these may be classified as follows: First, those making commodities in their entirety, ready for the consumer, as baskets, flooring, coffins; second, those manufacturing articles which are component parts of others, as hubs, spokes, or built-up tops; and third, those which take the several parts already manufactured, and merely assemble them to make a finished product. Some vehicle manufacturers are of this class. Table 4, which follows, contains no statistics obtained from the third class, but is compiled from data supplied by classes one and two.

The tendency in manufacturing is toward specialization, and as this becomes more general the number of industries increases, while the products of the separate manufacturers become less varied. Chairs, tables, kitchen safes, furniture, and upholstered furniture are, as a rule, products of different factories. Instead of all of these commodities being the output of a single furniture factory, as was formerly the case, they are separate and distinct industries in North Carolina, and are so treated in this report. This same tendency is seen, also, in other lines of manufacture, such as boxes and agricultural implements.

The manufacturing concerns of North Carolina, as shown in Table 4, are grouped in twenty-one industries. The line of distinction between these was in some cases quite arbitrarily drawn, difficulty being experienced in determining the boundary properly separating those industries whose products are very similar. Take, for example, the industries of flooring, siding, and stock molding; sash, doors, and blinds; and store and office fixtures. The sash and door factories often turn out interior finish of a high character which clearly belongs to the last-named industry. They also manufacture a finish of a class identical with regular stock molding produced by the planing mills of flooring, ceiling, siding, etc., manufacturers. Similar overlappings occur with other industries, making necessary a grouping of the data and its apportionment among the several industries concerned. Where less than three manufacturers producing similar commodities reported, separate classification was impracticable without revealing the information of the concerns reporting. To avoid this, and at the same time include the data in the report, several industries were combined under one heading. Shuttles, spools, bobbins, picker-sticks, and skewers will be found included under the heading of shuttles, spools, bobbins, etc.

Table 4 as presented herewith shows the total amount of raw material used in the State by manufacturers, the average price paid by the industries, the total amount of money invested annually in raw material, and the percentage which each one of these industries used of the total in North Carolina. To what extent the several industries purchase their lumber outside of the State can likewise be determined. It will be noted that this is expressed in approximate percentages of the amounts grown in and outside of North Carolina. Manufacturers of flooring, ceiling, siding, etc., purchased only 1 per cent outside of the State. Vehicle manufacturers purchased 44 per cent in other States, while eleven industries, as will be seen from the table, do not go outside of North Carolina for any of the raw material used.

TABLE 4.—ANNUAL CONSUMPTION OF RAW MATERIAL IN NORTH CAROLINA, BY INDUSTRIES.

INDUSTRY.	QUANTITY.		COST.		WHERE GROWN.	
	Feet b. m.	Per cent.	Total.	Average per M bd. ft. Delivered at Factory.	In North Carolina, Per cent.	Outside of North Carolina, Per cent.
Table 7. Flooring, ceiling, siding and stock moldings	310,330,000	45.9	$ 3,850,437.90	$ 12.41	99.0	1.0
Table 8. Furniture	100,343,250	14.9	1,828,752.34	18.23	92.6	7.4
Table 9. Boxes, box shooks, and crating	68,063,000	10.1	650,880.98	9.56	97.0	3.0
Table 10. Sashes, doors, blinds, etc.	57,686,000	8.5	783,862.77	13.60	98.9	1.1
Table 11. Chairs	47,325,000	7.0	867,221.70	18.33	97.1	2.9
Table 12. Tables, stands, and extension tables	31,868,000	4.7	543,939.46	17.06	91.7	8.3
Table 13. Trucks, vehicles and wagons	15,636,000	2.3	421,273.43	26.30	56.0	44.0
Table 14. Fruit and vegetable packages (veneer)	8,862,000	1.3	67,805.48	7.65	100.0	
Table 15. Insulator pins and brackets	5,600,000	.8	51,400.00	9.18	100.0	
Table 16. Coffins, caskets and casket cases	4,775,000	.7	81,599.72	17.09	92.9	7.1
Table 17. Tool and machinery handles	3,595,000	.5	62,193.50	17.30	100.0	
Table 18. Shuttles, spools, bobbins, etc.	3,480,000	.5	58,055.30	16.63	100.0	
Table 19. Farming implements	3,391,000	.5	40,534.83	11.95	100.0	
Table 20. Kitchen safes, cabinets and cupboards	3,325,000	.5	49,698.75	14.95	100.0	
Table 21. Cross-arms (telephone and telegraph)	2,816,000	.4	41,282.54	14.66	100.0	
Table 22. Pipes, pulleys and mine rollers	2,532,000	.4	21,240.00	17.00	100.0	
Table 23. Store and office fixtures, mantels, etc.	2,364,000	.4	81,607.67	34.52	81.2	18.8
Table 24. Musical instruments	1,800,000	.3	44,450.00	24.70	66.7	33.3
Table 25. Boat planking	800,000	.1	11,504.00	14.40	100.0	
Table 26. Excelsior	800,000	.1	6,352.00	8.31	100.0	
Table 27. Woodenware	775,000	.1	13,150.00	17.00	100.0	
Totals	676,166,250	100.0	9,577,242.37			

CONSUMPTION BY INDUSTRIES AND REGIONS.

Table 2 presented statistics showing the quantity of raw material grown in the State and used in the Coastal Plain, Piedmont, and Mountain regions of North Carolina. Table 5, which follows, has been compiled to show by industries the total consumption of wood for manufacture in the three regions. The average price paid per M feet, and the percentage of the total quantity of wood used by the various industries in each one of the regions, are also shown. For illustration, the box-makers in North Carolina used 68,063,000 feet of lumber, and 61.5 per cent of it was manufactured in the Coastal Plain, 38.5 per cent in the Piedmont region, and none in the Mountain districts. In figures it stands 41,903,000 feet for the Coastal region and 26,160,000 for the Piedmont. Again, in the sash and door industry the Piedmont region consumes 73.5 per cent, the Coastal Plain 22.3, and the Mountain region 4.2 per cent of the total material used by this industry in the State.

Of the woods used in making flooring, ceiling, siding, boxes, fruit and vegetable packages, farming implements, mine rollers, boat siding, and woodenware, more is consumed in the Coastal Plain than in the other two regions together. In the Piedmont region over 50 per cent of the total quantity of material used by thirteen industries is consumed in making furniture, sashes, doors, and blinds, chairs, tables, vehicles, coffins, and caskets, handles, shuttles, spools and bobbins, kitchin safes and cupboards, cross-arms, store and office fixtures, mantels and interior trimmings, and excelsior. The one remaining industry, manufacturing insulator pins and brackets, consumes in the Mountain region 64 per cent of wood entering into these products.

There are 676,166,250 feet of raw material going into manufactured articles annually in North Carolina, and of this total 43.9 per cent is used by the industries located in the Coastal Plain region, 54.2 per cent by the manufacturers in the Piedmont section, and 1.9 per cent by those of the Mountain region. Nearly six million dollars is expended annually in the Piedmont region for raw material delivered at the factory, three and one-half million is spent in the Coastal Plain, and less than two hundred thousand dollars in the Mountain region. This absence of wood-using industries in the mountains is accounted for chiefly by the lack of transportation facilities, which has existed in this region until quite recently, and the consequent cost of getting timber to market. The higher grades, which are the only ones that can profitably be hauled over these mountain roads any considerable distance, are usually shipped to the northern and western markets. With improved roads, however, and additional railroads, there is no reason why the Mountain region should not manufacture the greater part of its own raw material.

TABLE 5.—ANNUAL CONSUMPTION OF RAW MATERIAL IN NORTH CAROLINA, BY INDUSTRIES AND REGIONS.

INDUSTRY.	COASTAL PLAIN REGION.			PIEDMONT REGION.			MOUNTAIN REGION.		
	Quantity.		Cost.	Quantity.		Cost.	Quantity.		Cost.
	Feet b. m.	Per cent.		Feet b. m.	Per cent.		Feet b. m.	Per cent.	
Flooring, ceiling, siding and stock moldings	217,690,000	70.1	$ 2,714,793.80	90,360,000	29.1	$ 1,099,216.60	2,280,000	.8	$ 36,427.50
Furniture	3,751,000	3.7	56,375.86	94,401,250	94.2	1,739,148.20	2,191,000	2.1	33,228.28
Boxes, box shooks and crating	41,903,000	61.5	357,391.58	26,160,000	38.5	293,489.40			
Sashes, doors, blinds, etc.	12,883,000	22.3	160,642.65	42,407,000	73.5	581,676.88	2,396,000	4.2	41,543.24
Chairs	250,000	.5	3,500.00	47,075,000	99.5	863,721.70			
Tables, stands and extension tables	20,000	(*a*)	300.00	31,141,000	97.7	532,187.38	707,000	2.3	11,452.08
Trucks, vehicles and wagons	2,381,000	15.2	61,546.81	13,255,000	84.8	359,726.62			
Fruit and vegetable packages (veneer)	8,862,000	100.0	67,805.48						
Insulator pins and brackets				2,000,000	35.7	28,000.00	3,600,000	64.3	23,400.00
Coffins, caskets and casket cases	2,160,000	45.2	30,287.52	2,615,000	54.8	51,312.20			
Tool and machinery handles				2,120,000	58.8	46,873.20	1,475,000	41.2	15,320.30
Shuttles, spools, bobbins, etc.				3,150,000	90.8	54,003.60	330,000	9.2	4,051.70
Farming implements	2,950,000	86.9	31,351.45	416,000	12.3	8,683.38	25,000	.8	500.00
Kitchen safes, cabinets and cupboards				3,325,000	100.0	49,698.75			
Cross-arms (telephone and telegraph)	250,000	8.9	4,375.00	2,566,000	91.1	36,907.54			
Pipes, pulleys and mine rollers	2,510,000	99.1	21,020.00				22,000	.9	220.00
Store and office fixtures, mantels, etc.	66,000	3.9	1,320.00	1,750,000	74.0	62,940.77	548,000	22.1	17,346.90
Musical instruments				1,800.000	100.0	44,450.00			
Boat planking (worked)	800,000	100.0	11,504.00						
Excelsior				800,000	100.0	6,352.00			
Woodenware	650,000	84.0	11,200.00	25,000	3.3	450.00	100,000	12.7	1,500.00
Totals	297,126,000	43.9	3,533,414.15	365,366,250	54.2	5,858,838.22	13,674,000	1.9	184,990.00

a Less than one-tenth of one per cent.

FORM, GRADE, AND SIZES OF RAW MATERIAL.

In the foregoing tables and discussions the raw material used in North Carolina has been considered, first, as to quantity and species, and then as to industries. Table 6 treats of the raw material from a different standpoint, presenting the forms desired, the grades in which it is purchased, and the range of sizes acceptable. For instance, by consulting the table it can be learned that seventy-three concerns are classified under furniture. The material purchased by them is all in the form of rough-sawed lumber. Forty-five of these firms purchased log-run grades, while twenty-eight report buying established grades. The sizes of rough lumber purchased by the furniture makers range in thickness from $\frac{3}{4}$ to $\frac{46}{4}$, $\frac{1}{4}$ or 1 inch being the size most commonly used. As in other industries, the fact of the furniture manufacturers buying a portion of their raw material in the form of rough-sawed squares is indicated in the table by the asterisk (*). The smallest sizes in lumber purchased by any of the manufacturers making up the several industries can be seen from the last column of the table. This does not include squares.

That the manufacturers in North Carolina are located near the source of timber supply accounts for the fact that thirteen out of the twenty-one industries listed in the table secure all or some portion of their raw material in log form, seventeen report using rough-sawed lumber as raw material, while nine industries used billets or bolts from which to manufacture their products. See Plates II and III.

Owing to the incomplete data supplied by many of the firms reporting, these statistics do not present the matter in the definite form originally intended by this study. In its present shape, however, this report contains much useful information. It should help those wishing to sell their timber by acquainting them with the form in which each different industry desires raw material, whether in logs, in bolts, or in rough-sawed lumber. Where the raw material is rough lumber they can get some idea of the sizes used and the grades which will be received, whether log-run or established grades. A sawmill operator can learn what industries use sawed squares. By the addition of a rip and cut-off saw to his machinery he can manufacture squares from the inferior lumber that would otherwise be waste.

It will be noticed that many of the industries using rough lumber buy it in log-run rather than in established grades. This custom doubtless operates to the disadvantage of both the lumberman and the wood user. The lumberman could saw the lower grades into squares, and, grading his best lumber according to grading rules, would realize more for the

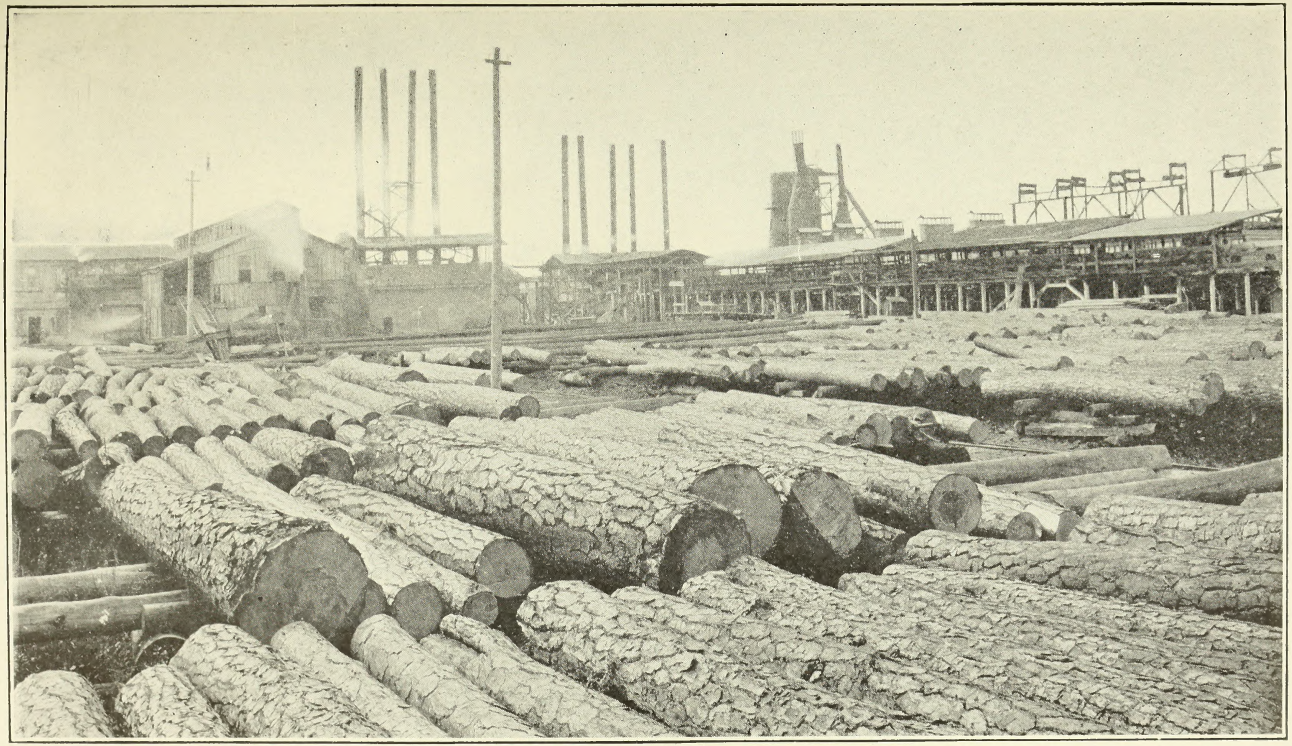


Plate II. Mill and Yard of Goldsboro Lumber Company, Dover, N. C. Manufacturers of high-class flooring, ceiling, siding and molding. The pine logs in the foreground are ready to be sawed.

TABLE 6.—NUMBER OF FIRMS, AND FORM, GRADE, AND SIZE OF RAW MATERIAL REQUIRED.

INDUSTRY.	Number of Firms Reporting.	FORM OF RAW MATERIAL (in percentage of quantity).			FIRMS BUYING LUMBER.		SIZE OF RAW MATERIAL REQUIRED.			Smallest Size Reported of Raw Material Purchased.
		Logs, Per cent.	Bolts and Billets, Per cent.	Lumber, Per cent.	Mainly Log-run, Number.	Mainly in Established Grades, Number.	Ranging— From—	Ranging— To—	Principally.	
Flooring, ceiling, siding and stock moldings	136	59.3		40.7	83	53	4-4	10-4	4-4	1"x3"-8'
Furniture	73			100.0*	45	28	3-4	16-4	4-4	1"x3"-10'
Boxes, box shooks and crating	46	26.7		73.3	28	18	3-8	6-4	4-4	1"x3"-6'
Sashes, doors, blinds, etc.	72	17.2		82.8	28	44	4-4	16-4	4-4	1"x4"-6'
Chairs	30	11.2		88.8*	10	20	4-4	10-4	Squares.	1"x3"-10'
Tables, stands and extension tables	20	3.7		96.3*	13	7	3-4	16-4	4-4 Lumber and squares.	1"x4"-any.
Trucks, vehicles and wagons	34	11.0		89.0*	4	30	3-8	12-4	Variable.	1"x4"-8'
Fruit and vegetable packages	15	68.7	31.3				6" diam.	and up.	12" logs.	1"x4"-8'
Insulator pins and brackets	3	35.0	20.0	45.0*		3			Squares.	
Coffins, caskets and casket cases	7	10.5		89.5	3	4	4-4	8-4	4-4	1"x4"-8'
Tool and machinery handles	10	5.8	68.2	26.0*		10			Squares.	
Shuttles, spools, bobbins, etc.	7		55.8	44.2*		7			Squares.	
Farming implements	6		19.6	80.4*	1	5	4-4	12-4	Variable.	1"x4"-8'
Kitchen safes, cabinets and cupboards	5			100.0	1	4	4-4	10-4	4-4	1"x4"-10'
Cross-arms (telephone and telegraph)	3		16.8	83.2*		3			Squares.	
Pipes, pulleys and mine rollers	4	70.4	29.6				6" diam.	and up.	12" logs.	
Store and office fixtures, mantels, etc.	18			100.0*			3-4	10-4	4-4	1"x6"-10'
Musical instruments	3			100.0*	1	2	3-4	12-4	4-4	1"x3"-6'
Boat planking (worked)	3	100.0					8" diam.	and up.	Logs.	6" diameter.
Excelsior	3		100.0				3" diam.	and up.	Split billets.	3" diameter.
Woodenware	3	45.7	25.7	28.6	2		6" diam.	and up.	Logs.	6" diameter.

*Purchase portion of lumber in form of "rough-sawed squares."

output of his mill than by selling the material in log-run form. The manufacturer would be relieved of the trouble of sawing the inferior grades into squares at the factory, and of the expense of paying for transportation, handling, and culling this log-run material, a large percentage of which will be a waste on his hands. The percentage of lumber suitable for further manufacture varies considerably in each consignment where materials are purchased in log-run grades. This brings about an element of uncertainty and often misunderstanding which can partly be eliminated if the lumber be purchased according to grades, and the squares according to specifications.

FLOORING, CEILING, SIDING, ETC.

So usual is it for sawmills in yellow-pine regions to market a large part of their cut in the form of flooring, ceiling, etc., that the public generally associates these products with the output of sawmills. The items in Table 7 represent that portion of the lumber produced by sawmills which, with the aid of planing-mill machinery, is converted into flooring, ceiling, siding, wainscoting, partitions, stock moldings, and casings. Roofers, box lumber, and boards merely surfaced are not considered as a part of these figures, as it is possible for these to be utilized later in the manufacture of other commodities. This table was compiled from statistics furnished by the sawmills which have planing-mill departments, but it includes, also, data furnished by the planing mills throughout the State which do not operate sawmills, but buy their lumber. Plate II.

This industry is the largest in the State, based on the quantity of wood used. Forty-five per cent of all the wood manufactured in North Carolina goes to these factories. The amount of money representing this raw material is over one-half of that expended by all the wood-using industries collectively. One-third of the number of wood users of all kinds in North Carolina are engaged in this industry.

By referring back to Table 6 it will be seen that more than half of the flooring, ceiling, and siding is produced by the same firm which cuts the rough lumber from the log from which these products are manufactured.

Yellow pine heads the list of species for quantity. It is the most abundant wood in the State, and the North Carolina manufacturers of these products use over fifty times as much of it as of all other woods combined. It enters into all the products of the flooring, ceiling, and siding industry, while yellow poplar is devoted mostly to the manufacture of siding and moldings. Cypress, being especially suitable for outdoor work, is used largely for porch flooring. Maple and oak are used in nominal amounts and are converted into flooring and inside trimming.

The proportion of each kind of wood used in this industry to the total of that wood used in the State is seen by consulting the last column of Table 7. This shows that 72.4 per cent of all the yellow pine manufactured in North Carolina is converted into flooring, ceiling, siding, etc., while 87 per cent of the cypress is taken by this industry, and 7 per cent of the poplar.

TABLE 7.—FLOORING, CEILING, SIDING, AND STOCK MOLDING.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina and longleaf pine	302,075,000	$ 12.35	3,050,000	$ 13.48	305,125,000	$ 12.37	$ 3,775,717.90	72.40
Cypress	2,400,000	14.00			2,400,000	14.00	33,600.00	87.00
Yellow poplar	2,375,000	13.86			2,375,000	13.86	32,917.50	7.00
Red and white oak	400,000	17.85			400,000	17.85	7,140.00	.27
Hard maple			25,000	40.00	25,000	40.00	1,000.00	.60
Chestnut	5,000	12.50			5,000	12.50	62.50	.06
Totals	307,255,000	12.38	3,075,000	13.70	310,330,000	12.41	3,850,437.90	

FURNITURE.

The furniture industry, as here considered, includes bedroom suits and odd pieces like chiffoniers, dressing-tables, shaving-stands, sofas, hall racks, settees, lounges, sideboards, buffets, china closets, plate racks, music cabinets, piano stools and benches, parlor cabinets, etc. Chairs, tables, and kitchen safes are not included in this table, the manufacture of these being treated as separate industries. Had all furniture making been grouped in one industry, the 100,000,000 feet shown in Table 8 would be increased to 183,000,000 feet, while the total annual expenditure for raw material would aggregate $3,240,000. This emphasizes the importance of the various branches of furniture making in North Carolina.

In the quantity of material used, as well as in its cost, furniture is second among the wood-using industries of the State. Fifteen per cent of the wood used in the State for manufacturing purposes goes into furniture, and 45 per cent into flooring, ceiling, siding, etc. The furniture makers paid an average price of $18.23 per M feet, which was 50 per cent higher than that paid for raw material consumed by the flooring, ceiling, siding, etc., industry. See Plates I and III.

Only 7½ per cent of the 100,000,000 feet of lumber used by the furniture manufacturers is grown outside of North Carolina. Sweet birch comes from Michigan and mahogany is imported; the remainder of that which is shipped into this State, including poplar, chestnut, and gum, comes from neighboring States.

The quantity of oak used was more than three times the amount of any other wood reported. Of this white oak leads in quantity, red oak follows, and Spanish oak is least. The best grades of oak are used for the outside of furniture, the lower grades for frame work and cores for veneering. The price paid for home-grown oak was $18.41 per M feet. That shipped in cost $10.47 more per M feet. The imported oak included much quarter-sawed oak. Fifty per cent of the oak shipped into the State for all purposes is taken by furniture manufacturers.

Yellow poplar comes second in importance in the manufacture of furniture. More yellow poplar is brought into the State by this industry than all other species combined. Furniture manufacturers pay $1.51 per M feet less for home-grown poplar than for that bought in other States. The total amount of this wood used for furniture is 19,000,000 feet, a little more than 1 per cent of all the poplar manufactured in the State.

In relative quantity of wood used North Carolina pine comes third on the list in this industry. The amount used, however, is less than one-third that of yellow poplar, and one-tenth that of the oak. Its use is chiefly for the inside of furniture and for veneer cores. The average cost per M feet was $14.61 in this industry.

Seventeen per cent of the total amount of chestnut and the same proportion of the total amount of white pine used for all purposes of manufacture in North Carolina were used in this industry. Black walnut is not reported in the State by furniture makers, and mahogany is the only imported wood reported, a portion of which was purchased in the form of veneering. The average cost of mahogany delivered at the factory was $159.21 per M feet.

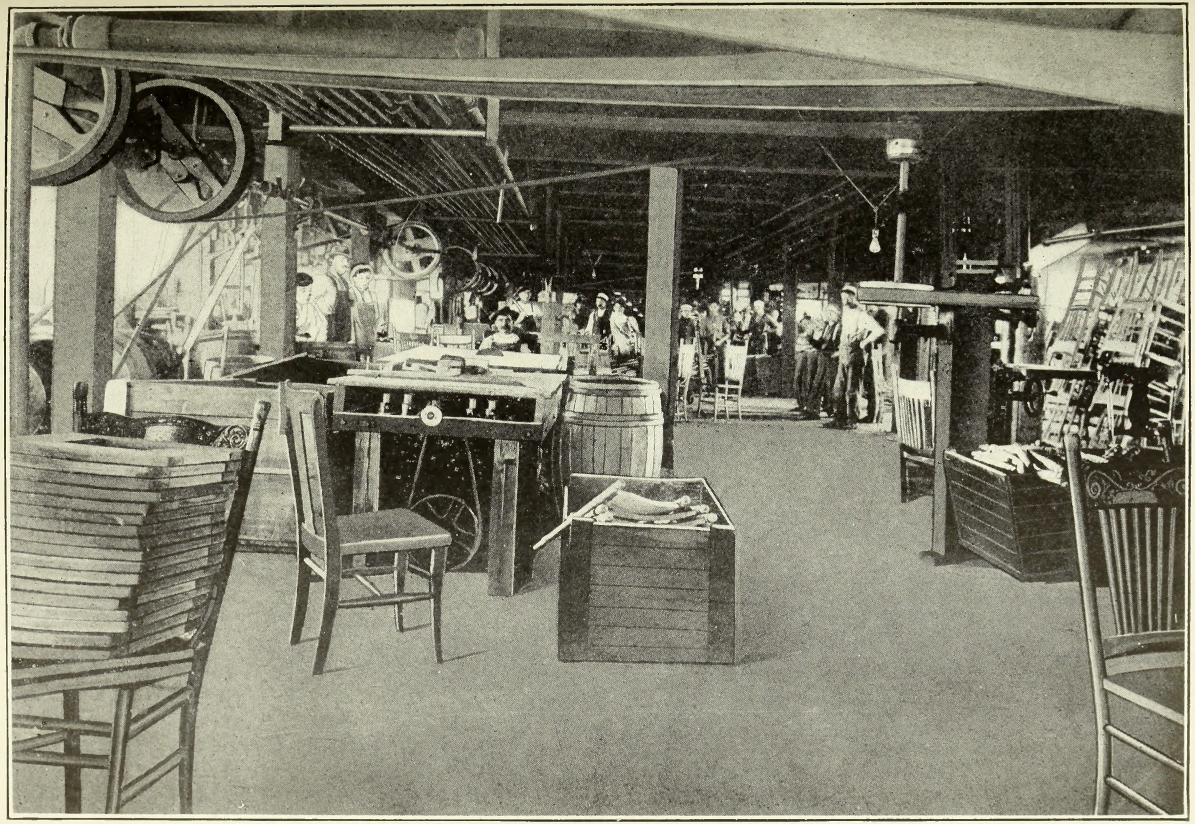


Plate III. Main floor of the factory of the Southern Chair Company, High Point, N. C.

TABLE 8.—FURNITURE (GENERAL).

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Oak	63,331,000	$ 18.41	2,556,000	$ 28.88	65,887,000	$ 18.41	$ 1,239,748.00	45.42
Yellow poplar	14,526,000	17.10	4,428,000	18.61	18,954,000	17.20	332,189.00	1.40
North Carolina pine	5,970,000	14.61			5,970,000	14.61	86,221.70	1.40
Chestnut	4,555,000	15.60	100,000	15.00	4,655,000	15.60	72,558.00	16.90
White pine	2,210,000	18.28			2,210,000	18.28	40,398.80	16.90
Red and tupelo gum	1,415,000	17.36	300,000	25.00	1,715,000	19.28	33,064.40	7.03
Maple	325,000	18.22			325,000	18.22	5,921.50	8.00
White ash	258,000	20.85			258,000	20.85	5,379.30	18.20
Sycamore	104,000	14.04			104,000	14.04	1,460.16	28.20
Beech	75,000	22.13			75,000	22.13	1,659.75	48.40
Birch	71,000	21.00	55,000	34.73	126,000	28.30	3,401.00	24.60
Mahogany			39,250	159.21	39,250	159.21	6,250.00	61.10
Basswood	25,000	20.00			25,000	20.00	500.00	9.40
Totals	92,865,000	17.81	7,478,250	23.37	100,343,250	18.23	1,828,752.34	

BOXES AND CRATES.

As each year the virgin stands of timber in North Carolina approach nearer to exhaustion the sawmill man seeks to supply his demands more and more from the second and even the third growths of timber. This necessity has become well-nigh universal in the yellow-pine districts, resulting in a considerable increase in the quantity of the lower grades of lumber. The necessity for utilizing these lower grades is, no doubt, one of the chief factors in developing, in North Carolina, the manufacture of boxes. There is a grade of yellow-pine lumber which is known to the trade as "boxing"; this, however, is not included in these statistics. The figures and items in Table 9 refer to material actually consumed in the making of boxes and crates by the several woodworking industries of the State. The box manufacturers use over 68,000,000 feet of timber annually, making this industry third in the State for quantity used. The cost of the material was $651,000, an average price of $9.56 per M feet. All the material going into boxes and box shooks is supplied by North Carolina, excepting 2,000,000 feet, which is reported grown in South Carolina at $1 more per M feet than the home-grown yellow pine. North Carolina pine makes up two-thirds of the box material, while gum is second in importance. For exportations, especially to South Africa and Australia, gum boxes are in great demand. The trade to these foreign countries contends that goods sell more readily in packages made of this material. This has brought about an increasing demand for gum box shooks, and accounts for the fact that 54½ per cent of all the gum consumed in the State of North Carolina is manufactured into these products. White pine is also an important wood for the box makers, who use 47 per cent of all this wood purchased by the manufacturers in the State. A fourth of the box makers in North Carolina cut their material from the log, and the industry is becoming closely allied with the large sawmills which are striving more and more to put to some use those grades of lumber that would otherwise go to waste. Boxes and box shooks are not all made of the lower grades of lumber, as they must vary in price and grade according to use. Some high-priced boxes require the best grades of lumber, such as trunks, sample cases, and packages designed for the shipment of goods of fine textures where the exclusion of moisture and dust is of prime consideration.

TABLE 9.—BOXES, BOX SHOOKS, AND CRATING.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	43,227,000	$ 9.12	2,000,000	$ 10.38	45,227,000	$ 9.17	$ 414,980.24	10.70
Red and tupelo gum	13,301,000	8.21			13,301,000	8.21	109,201.21	54.57
White pine	6,210,000	13.18			6,210,000	13.18	81,847.78	47.40
Yellow poplar	2,526,000	14.75	50,000	17.00	2,576,000	14.79	38,101.75	12.20
Maple	500,000	8.50			500,000	8.50	4,250.00	12.20
Cypress	250,000	10.00			250,000	10.00	2,500.00	9.04
Totals	66,014,000	9.53	2,050,000	10.54	68,064,000	9.56	650,880.98	

SASH, DOORS, BLINDS, ETC.

The makers of sash, doors, and blinds often manufacture inside and outside finish for buildings. The industry differs from that which turns out flooring, ceiling, stock molding, and siding, in that it calls for more complicated machinery and usually requires labor of greater skill. Special designs are frequently required, and each must be worked out with judgment and care. Stairways, newel and landing posts, archways, special wainscoting, casing and moldings to order, store fronts, cornice work, porch work, brackets, and spindles, are illustrations.

Fourteen kinds of wood are demanded by the sash and door factories of North Carolina, and 57,600,000 feet are used yearly, which is more than 8½ per cent of all the wood manufactured in the State. Yellow pine, which includes North Carolina pine and some longleaf, leads the list in quantity and cost. The quantity is 85 per cent of the total wood used by this industry, of which 1,000,000 feet, mainly longleaf pine, was shipped into the State from South Carolina. The imported pine cost about $1 per M feet more than that grown in North Carolina. White pine is next in quantity and constitutes 27 per cent of all the white pine manufactured in the State. It is all grown in North Carolina and, as shown in the table, was purchased at an average price of $17.95, delivered at the factory. The price paid for yellow poplar recorded in Table 10 was $2.09 more per M feet than was paid by the flooring, ceiling, siding, etc., manufacturers, and $1.25 less than the price paid by the furniture makers. Spruce, purchased at $12.50 per M feet, cottonwood, cucumber, and box elder, at $12 per M feet, were not reported for any other industry in North Carolina. This industry demanded 35,000 feet of ash, which was one-fourth of all reported in the State.

TABLE 10.—SASH, DOORS, BLINDS, AND INTERIOR FINISH (MILL WORK).

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	50,636,000	$ 12.71	1,000,000	$ 13.60	51,636,000	$ 12.90	$ 665,791.68	12.30
White pine	3,525,000	17.95			3,525,000	17.95	63,273.75	26.90
Yellow poplar	835,000	15.95			835,000	15.95	13,318.25	2.40
Red and white oak	668,000	26.88	90,000	40.00	758,000	28.43	21,555.84	.52
Chestnut	386,000	17.30			386,000	17.30	6,677.80	5.00
Spruce	150,000	12.50			150,000	12.50	1,875.00	100.00
Basswood	100,000	18.00			100,000	18.00	1,800.00	38.00
Yellow birch	95,000	36.82			95,000	36.82	3,599.55	18.50
Cypress			60,000	50.00	60,000	50.00	3,000.00	2.20
Red and tupelo gum	56,000	16.00			56,000	16.00	896.00	.23
Ash	35,000	42.14			35,000	42.14	1,474.90	2.47
Cottonwood	30,000	12.00			30,000	12.00	360.00	100.00
Cucumber	15,000	12.00			15,000	12.00	180.00	100.00
Box elder	5,000	12.00			5,000	12.00	60.00	100.00
Totals	56,536,000	13.51	1,150,000	17.57	57,686,000	13.60	783,862.77	

CHAIRS.

Table 11 gives statistics of chair manufacturing in North Carolina. From the standpoint of the retail merchant and the consumer chairs are considered furniture, but from the point of view of the manufacturer they are considered separate and distinct. Chairs of practically all kinds are made in North Carolina—reclining chairs, rockers, patent rockers, diners, morris chairs, hall chairs, porch chairs, official chairs for lodge-rooms, and stools of many kinds. Chair stock shipped into the State in a knocked-down condition, to be assembled and finished after its arrival here, was not included in this report, nor was any information turned in from upholstering concerns. See Plates III and IV.

The chair industry is fifth in importance in North Carolina from the standpoint of the amount of wood used, and, as in the case of furniture making, is confined almost exclusively to the Piedmont region. Only 250,000 feet out of a total of 47,325,000 used by chair makers in the State is consumed outside the borders of this region. Seven kinds of woods are reported used in this industry. Oak, of the same species as are used in furniture manufacturing, represents 97 per cent of the total quantity of raw material demanded by this industry. It is one-third of all the oak used by manufacturers in the State. Maple, yellow poplar, and hickory, in the order named, follow oak in quantity used. Only 3 per cent of the chair material is grown outside of the State. Fifty-eight per cent of the chair-making concerns buy a portion of their raw material in the form of rough-sawed squares. This is of importance to mill men, who can make use of waste by sawing it in squares of suitable dimensions.

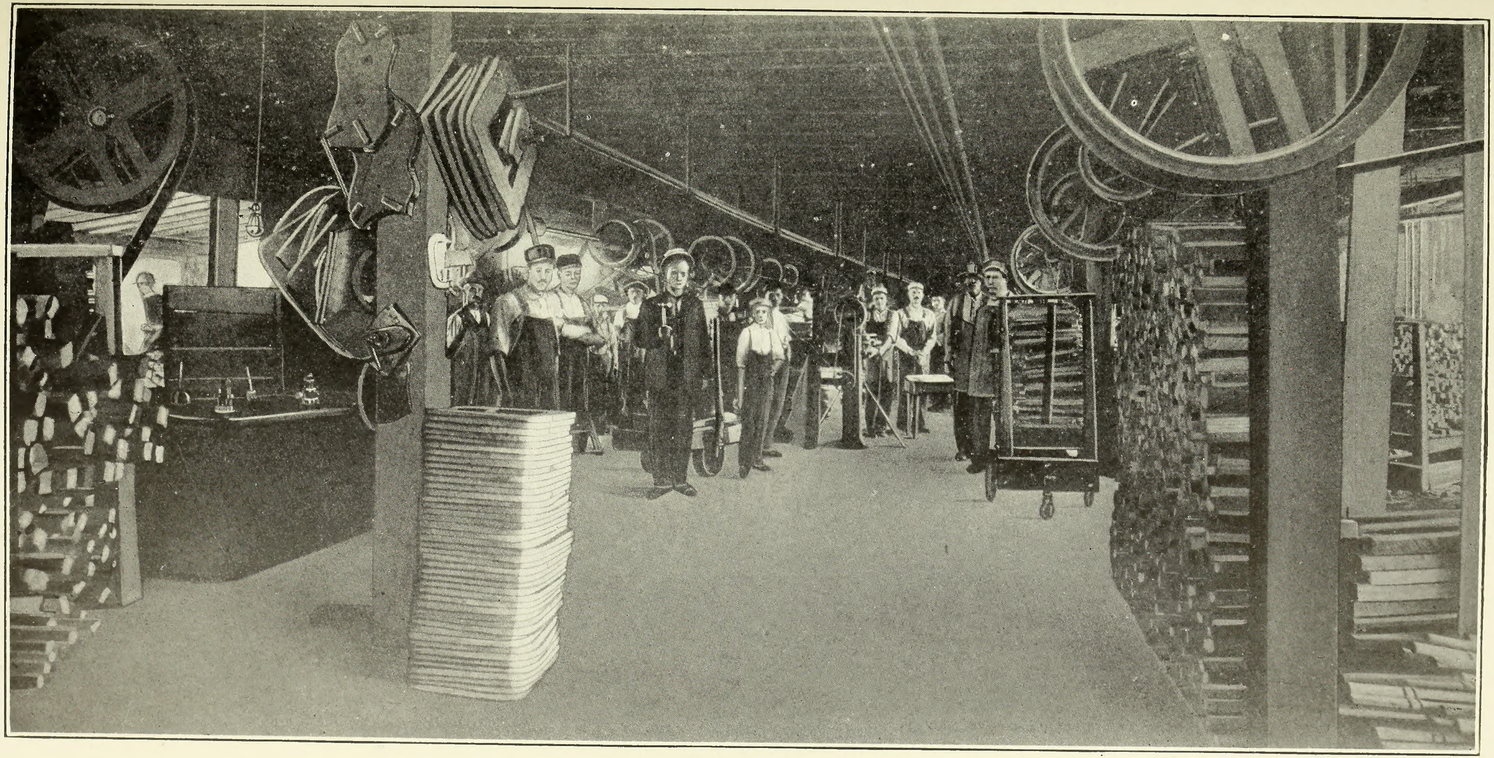


Plate IV. Turning room of the Southern Chair Company, High Point, N. C.

TABLE 11.—CHAIRS, ROCKERS, AND RECLINING CHAIRS.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, chestnut and Spanish oak	43,955,000	$ 17.91	1,150,000	$ 27.80	45,105,000	$ 18.16	$ 819,183.05	31.09
Hard maple	830,000	20.23			830,000	20.23	16,790.90	20.20
Yellow poplar	475,000	23.27	220,000	25.45	695,000	24.00	16,653.25	2.00
Hickory	585,000	21.70			585,000	21.70	12,694.50	5.30
Red gum	50,000	12.00			50,000	12.00	600.00	.21
Birch	50,000	22.50			50,000	22.50	1,125.00	9.70
Elm	10,000	17.50			10,000	17.50	175.00	5.10
Totals	45,955,000	18.05	1,370,000	27.41	47,325,000	18.33	867,221.70	

TABLES.

The manufacture of tables in North Carolina is in itself a large industry, entirely distinct from that of furniture making. Like furniture and chairs, the manufacturers making tables are located mostly in the Piedmont region of the State. Every kind of table from the cheapest for kitchen use to the most elaborately carved parlor and library table is manufactured. Table 12 shows that 31,868,000 feet of lumber, or 5 per cent of the total consumed in manufacturing in the State, were used, at an average cost of $17.06 per thousand. Red, white, Spanish, and chestnut oak, aggregating 21,947,000 feet, head the list of woods for this industry. The wood is all grown in North Carolina and is 15 per cent of the total oak used by manufacturers in this State. Longleaf and North Carolina pine are next in importance to oak for the manufacture of tables. This, too, was State grown, and 4,520,000 feet were purchased at an average of $13.14 per thousand. Of the 4,000,000 feet of poplar going into tables, 65 per cent is shipped in from neighboring States, Tennessee furnishing the larger portion of it. The average price for poplar in this industry was $20.96, which is $3.76 more than was paid for this wood by furniture manufacturers. Chestnut, which stands next to poplar in quantity, is used mostly for cores in making built-up table tops; 1,000,000 feet was reported, which was 13 per cent of the total chestnut manufactured in North Carolina. The remaining species named in the following table are used in very nominal quantities and range in price from $16 per M feet for basswood to $120 per M for mahogany.

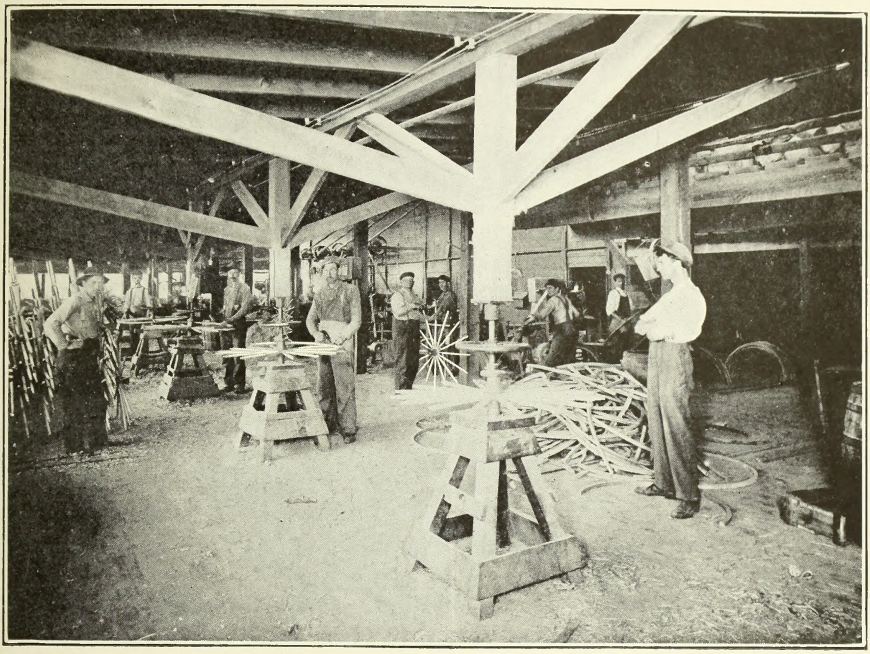
TABLE 12.—TABLES, STANDS, AND EXTENSION TABLES.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, Spanish and chestnut oak	21,947,000	$ 17.13		$	21,947,000	$ 17.13	$ 375,952.11	15.13
North Carolina pine	4,470,000	12.96	50,000	30.00	4,520,000	13.14	59,431.20	1.00
Yellow poplar	1,495,000	18.57	2,600,000	22.55	4,095,000	20.96	85,820.15	11.60
Chestnut	1,000,000	17.20			1,000,000	17.20	17,200.00	12.90
Ash	100,000	17.00			100,000	17.00	1,700.00	7.06
Basswood	100,000	16.00			100,000	16.00	1,600.00	38.00
Red gum	51,000	20.00			51,000	20.00	1,020.00	.21
Maple	50,000	20.00			50,000	20.00	1,000.00	1.20
Birch	2,000	24.00			2,000	24.00	48.00	.40
Cherry	2,000	24.00			2,000	24.00	48.00	6.90
Mahogany			1,000	120.00	1,000	120.00	120.00	1.60
Totals	29,217,000	16.57	2,651,000	22.72	31,868,000	17.06	543,939.46	

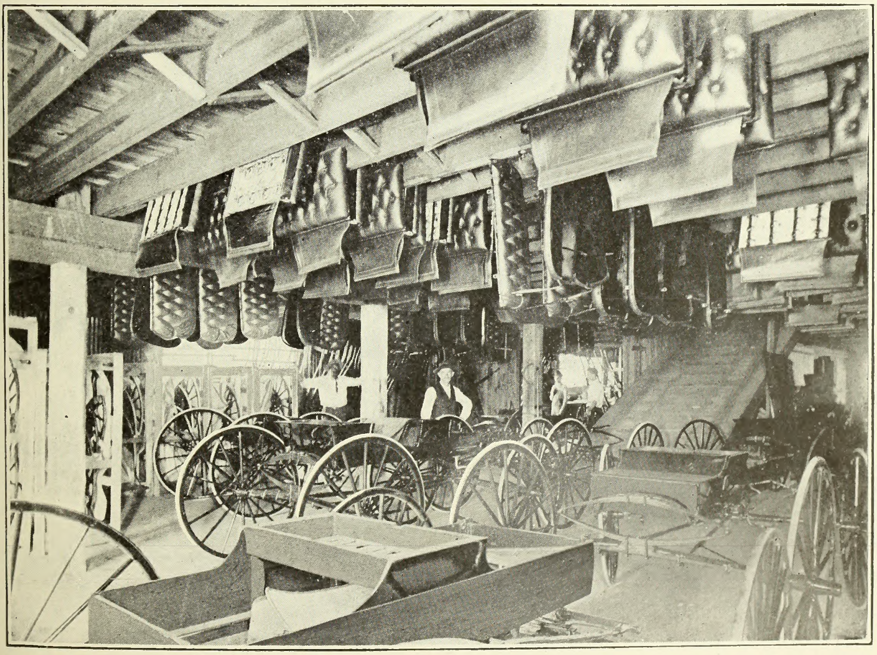
VEHICLES.

Vehicles of all kinds are included in this industry, from the finest finished carriage and phæton down to the dump-cart and the logging truck. Table 13 does not represent the full amount of material consumed in the manufacture of vehicles in North Carolina, though it comprises a very large percentage. In every village, town, and city of the State there are wagon makers who turn out a few vehicles in the course of the year, but whose chief work is repairing. A large quantity of wood is used. An effort was made to include all, but lack of information as to the exact locations of many, and the indifference of others to the work, and their ignoring requests for information, made the collecting of this data more difficult than for any other industry. The convenience of being near the source of supply has attracted to North Carolina large manufacturers of vehicles. See Plate V, A and B.

A number of the manufacturers of vehicles in this State merely assemble the component parts and put on the finishing touches. Information from this class, as stated before, was not solicited. The data furnished by the manufacturers of hubs, rims, spokes, bodies, axles, etc., together with the amount of raw material used by those industries which make the vehicle in all its parts, are shown in Table 13. Eight woods are listed, and hickory leads the list in quantity, being 60 per cent of all the hickory reported in the State. Forty-four per cent of the vehicle wood grew outside the State, no other industry reporting so large a percentage of its material. Tough, strong woods are essential, and this accounts for the fact that average prices paid by vehicle makers for their woods were above those in any other industry. High grades of lumber were demanded. In this connection it is worthy of note that 88 per cent of the manufacturers listed under this industry purchased their material in established grades, which was above the percentage of any other industry.



A. INTERIOR VIEW OF WHEEL FACTORY OF HIGH POINT BUGGY COMPANY, HIGH POINT, N. C.



B. INTERIOR VIEW OF PACKING DEPARTMENT OF HIGH POINT BUGGY COMPANY, HIGH POINT, N. C.

TABLE 13.—TRUCKS, VEHICLES, AND WAGONS.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Hickory	1,440,000	$ 34.43	5,145,000	$ 28.93	6,585,000	$ 29.08	$ 191,532.10	60.00
White oak	3,260,000	26.40	1,025,000	22.63	4,285,000	25.50	109,314.00	3.00
Yellow poplar	1,404,000	29.80	655,000	31.29	2,059,000	30.32	62,336.69	5.80
North Carolina pine	1,431,000	18.12	25,000	20.00	1,456,000	18.29	26,429.72	.40
White ash	884,000	27.88	10,000	30.00	894,000	27.88	25,045.92	63.10
Red gum	250,000	18.30			250,000	18.30	4,575.00	1.03
Elm	87,000	20.00			87,000	20.00	1,740.00	44.10
Hard maple	20,000	15.00			20,000	15.00	300.00	.50
Totals	8,776,000	25.96	6,860,000	28.19	15,636,000	26.30	421,273.43	

FRUIT AND VEGETABLE PACKAGES.

The products of this industry comprise baskets and packages in which fruit and vegetables are shipped and marketed. The growing custom of selling provisions to the consumer in individual packages has in recent years increased the importance of this industry in North Carolina. The commodities are grape baskets, fruit baskets, berry cups, vegetable cups, hoppers, barrels (veneer), and vegetable crates, and the business of making them is confined to the Coastal region, where truck farming and fruit growing is a thriving and rapidly-growing industry.

The raw material is delivered to the basket maker in log form, and this accounts for the low price paid as compared with the other industries. The price was $7.65 per M feet log scale, and was the lowest reported by any of the twenty-one industries. It was 66 cents lower than the price paid by excelsior makers, who buy their wood in the forms of billets and poles.

Six kinds of wood were reported, as shown in Table 14. The first process of manufacture consists in converting the logs into sheets of veneer, and a further process finishes the articles. The cores which remain after the veneer is cut from the logs are largely sawed into thin lumber and utilized for the covers and bottoms of barrels, hoppers, baskets, etc., and for making light vegetable crates.

In the quantity of wood consumed this class of manufacturers stands seventh on the list of North Carolina's wood-using industries, while in the amount of money paid for raw material it ranks ninth on the list.

All of the wood used is grown in the State, and in board measure amounts to 8,862,000 feet. Red and tupelo gum, the former being more extensively employed, head the list for quantity. More red gum is cut into veneers than any other wood, and a large percentage of it goes into baskets, crates, and packages. North Carolina pine is second on the list in the quantity used. As in the case of boxes, large sawmills often manufacture fruit and vegetable packages as a side line.

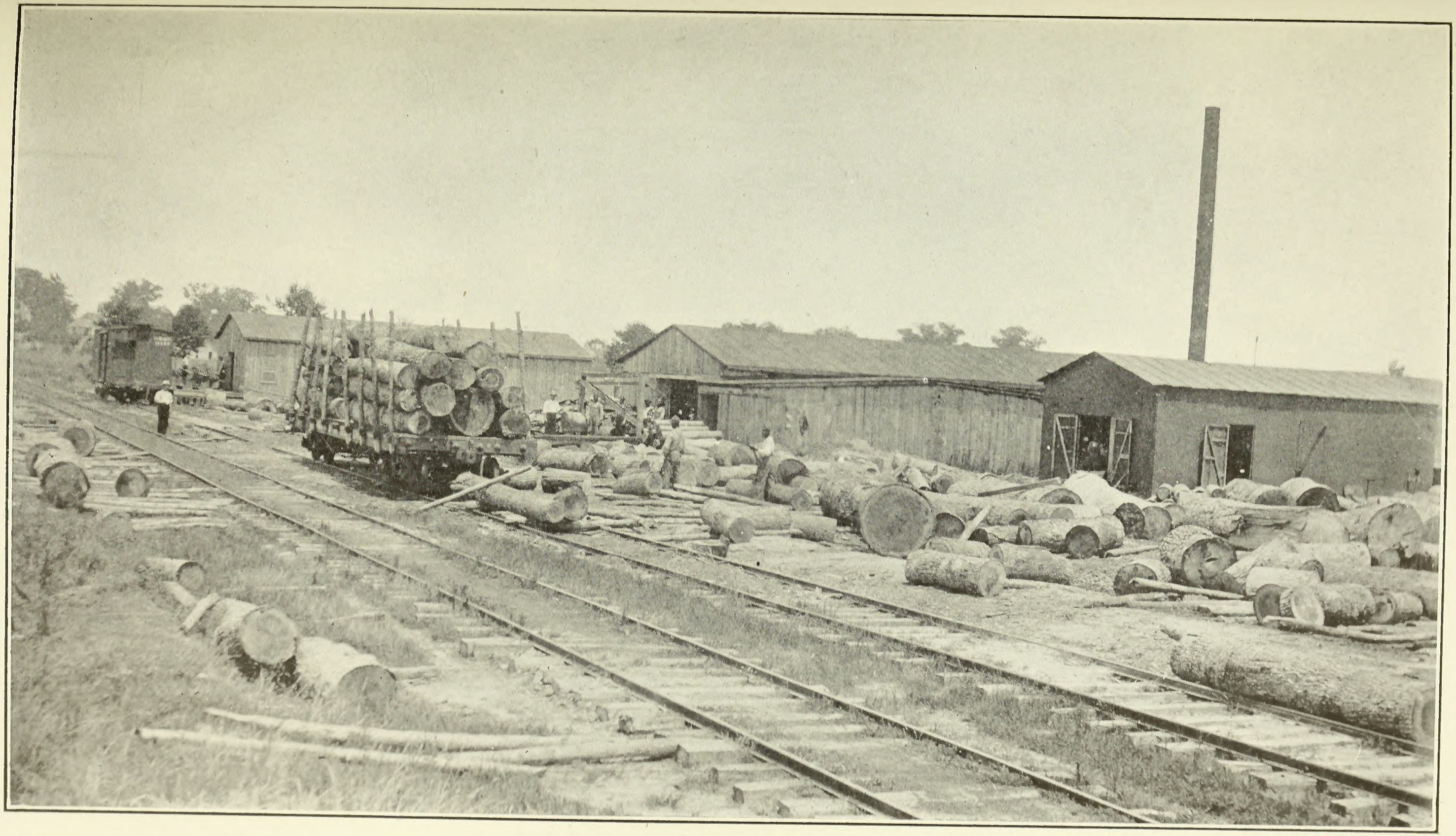


Plate VI. Mill and yard of the Wilkes Veneer Company, Edenton, N. C.

Carolina
State Library.

TABLE 14.—FRUIT AND VEGETABLE PACKAGES.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and tupelo gum	6,180,000	$ 7.67		$	6,180,000	$ 7.67	$ 47,400.60	25.36
North Carolina pine	2,020,000	7.26			2,020,000	7.26	14,665.20	.50
Yellow poplar	362,000	9.64			362,000	9.64	3,489.68	1.03
Maple	150,000	8.00			150,000	8.00	1,200.00	4.00
Elm	100,000	7.00			100,000	7.00	700.00	50.80
Sycamore	50,000	7.00			50,000	7.00	350.00	13.60
Totals	8,862,000	7.65			8,862,000	7.65	67,805.48	

INSULATOR PINS AND BRACKETS.

Makers of insulator pins and brackets bought all their wood in North Carolina. This industry stands ninth on the list for quantity of material consumed. Only three woods are reported, white and chestnut oak, and yellow locust. The 3,000,000 feet of oak utilized is 2 per cent of the total amount of this kind of wood used in this State. The average price per M feet paid is less than that reported for this wood by any other industry. This is because raw material for making insulator pins is bought as logs and bolts. The yellow locust recorded in Table 15 constitutes the whole of this wood reported in the State, and the amount consumed was 2,600,000 feet, the price paid being $14 per thousand feet.

TABLE 15.—INSULATOR PINS AND BRACKETS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White and chestnut oak	3,000,000	$ 5.00	$ 15,000.00	2.06
Yellow locust	2,600,000	14.00	36,400.00	100.00
Totals	5,600,000	9.18	51,400.00	

COFFINS, CASKETS, AND CASKET CASES.

Notwithstanding that many of the coffins and caskets sold in North Carolina are manufactured elsewhere, this industry stands tenth on the list in quantity of lumber used, the amount being 5,000,000 feet annually, at an average cost of $17.09 per M. This is one of only eight industries considered in this report which pays more than an average of $17 per M feet for raw material. North Carolina pine is highest in quantity used, as is shown in Table 16, which records the use of seven other woods. More than 10 per cent of the pine is grown outside of the State, and is reported shipped from South Carolina. This industry paid 73 cents more for yellow pine than was paid by the makers of sash, doors, and blinds, and $1.26 more than the average paid by the manufacturers of floor, ceiling, and siding. North Carolina pine is used in making all the products of this industry, while chestnut, following next in importance, is utilized only for making caskets. The total chestnut used was 1,300,000 feet, which was 17 per cent of all the chestnut manufactured in North Carolina. The sound wormy is the grade most commonly desired. The average price of this delivered at the fac-

TABLE 16.—COFFINS, CASKETS, AND CASKET CASES.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	1,899,000	$ 13.48	200,000	$ 15.00	2,099,000	$ 13.63	$ 28,610.02	.50
Chestnut	1,300,000	18.00			1,300,000	18.00	23,400.00	16.80
White pine	595,000	22.02			595,000	22.02	13,143.55	4.50
Yellow poplar	455,000	18.53	100,000	24.00	555,000	19.51	10,831.15	1.60
Red cedar	125,000	25.00			125,000	25.00	3,125.00	86.20
Black walnut	50,000	31.60			50,000	31.60	1,580.00	8.50
Cypress			40,000	20.00	40,000	20.00	800.00	1.40
White oak	11,000	10.00			11,000	10.00	110.00	.008
Totals	4,435,000	17.03	340,000	18.00	4,775,000	17.09	81,599.72	

tory is $18 per M feet. All the chestnut used was State grown. Higher grades of white pine are demanded by this industry than by any other in the State, and its average price was $22.02, while the price paid by the sash, door, and blind manufacturers was only $17.95. Of the poplar consumed by the coffin and casket makers, 20 per cent is grown outside of the State, and comes from Tennessee. Red cedar is used for manufacturing both coffins and caskets, while black walnut is used only for coffins. The prices paid for these two species are higher than any of the others in this industry. Black walnut averaged $31.60 per M feet, and red cedar $25.

HANDLES.

The kinds of handles manufactured by this industry in North Carolina are, axe, pick, maul, sledge, hammer, tool, and machinery. Hickory alone is used in the making of these handles, being the only available wood possessing the necessary qualities of flexibility and strength. As shown in Table 17, the handle makers consume 3,595,000 feet annually. This is purchased in the form of bolts and billets, and represents one-third of the hickory used in manufacture in the State. All of this material was grown in North Carolina, and its average price was $17.30 per thousand feet.

TABLE 17.—AXE, TOOL, AND MACHINERY HANDLES.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Hickory	3,595,000	$ 17.30	$ 62,193.50	32.60

SHUTTLES, SPOOLS, BOBBINS, ETC.

Statistics of this industry include shuttles, spools, bobbins, skewers, and picker-sticks. These articles are not all made in the same factories, but they have been grouped together for convenience of compilation. The raw material was purchased in the form of logs, bolts, billets, and sawed squares. The average prices given in the table are for so many forms and sizes that they are of little value for comparison and study. Seven woods were reported, the list being headed by maple, which totaled 2,160,000 feet. Dogwood and persimmon were reported for this industry alone, and are used almost exclusively in making shuttles. Dogwood stands second on the list in quantity. Two per cent of the hickory used in the State goes into the products of this industry, principally into skewers and picker-sticks. The birch is manufactured into bobbins, spools, skewers, and picker-sticks. Thirty-one per cent of all the birch manufactured in the State, and 38 per cent of the beech go into these articles.

TABLE 18.—SHUTTLES, BOBBINS, SPOOLS, AND SKEWERS.

KIND OF WOOD.	RAW MATERIAL USED ANNUALLY, AND GROWN IN NORTH CAROLINA.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Maple	2,160,000	$ 15.14	$ 32,702.40	53.00
Dogwood	600,000	18.75	11,250.00	100.00
Hickory	240,000	28.13	6,751.20	2.20
Birch	160,000	16.25	2,600.00	31.20
Persimmon	150,000	20.00	3,000.00	100.00
Yellow poplar	110,000	10.47	1,151.70	.31
Beech	60,000	10.00	600.00	38.70
Totals	3,480,000	16.63	58,055.30	

FARMING IMPLEMENTS.

The manufacturers of farming implements report using 3,391,000 feet of lumber annually, which is one-half of 1 per cent of the total consumed by all the manufacturers in the State in 1909. Only four woods are reported—gum, oak, and white and yellow pine. Seventy-three per cent was red and tupelo gum, which was 10 per cent of all the gum manufactured in the State. Oak is next in quantity used by these manufacturers, red oak, white oak, and post oak being reported. The average cost per M feet was $20.18, which was higher than the price paid for oak by the furniture, chair, and table manufacturers. North Carolina pine stands third on the list, being less than 10 per cent of the wood used in this industry. The average price for white pine was $54 per M feet, which was the highest price reported in the State for American woods. Table 19 below presents the available statistics:

TABLE 19.—FARMING IMPLEMENTS.

KIND OF WOOD.	RAW MATERIAL USED ANNUALLY, AND GROWN IN NORTH CAROLINA.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and tupelo gum	2,500,000	$ 10.00	$ 25,000.00	10.26
Red, white and water oak	546,000	20.18	11,018.38	.37
North Carolina pine	335,000	11.87	3,976.45	.08
White pine	10,000	54.00	540.00	.08
Totals	3,391,000	11.95	40,534.83	

KITCHEN SAFES.

This is the third subdivision of furniture classified in this study as a distinct industry. It includes cupboards, safes, and cabinets. A cabinet is a kind of safe whose space is ingeniously divided up into many compartments, providing a convenient place for provisions usually kept on hand in the kitchen, such as flour, sugar, meal, salt, coffee, etc. This class of furniture is more cheaply manufactured than articles for living-rooms and parlors, and it does not require the skill of highly trained workmen, nor the best grades of lumber for its manufacture. Oak is the principal wood used, and averages in price only $11.39 per M, while the oak from which chairs and tables are made was reported at a cost of $18.16 and $17.13 per M, respectively. The quantity of yellow poplar used was 1,575,000 feet, that being only 75,000 feet less than the quantity of oak used. It was all grown in North Carolina, making this the only industry considered in this study in which all of the poplar used was grown in the State. The average price for this kind of wood was $18.67 per M, which was $1.47 higher than the price paid by the furniture makers. The oak is mostly used for the outside work of safes, cabinets, and cupboards, while poplar is utilized for inside work, such as shelvings, partitions, etc., and for both inside and outside work of the cabinets. The chestnut was of the sound wormy grade, a limited quantity only being used in 1909. The cost is about the average reported by other industries for this kind of wood. It is all grown in North Carolina.

TABLE 20.—KITCHEN SAFES, CABINETS, AND CUPBOARDS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red, white, post and Spanish oak	1,650,000	$ 11.39	$ 18,793.50	1.13
Yellow poplar	1,575,000	18.67	29,405.25	4.50
Chestnut	100,000	15.00	1,500.00	1.30
Totals	3,325,000	14.95	49,698.75	----- --------

CROSS-ARMS.

The making of cross-arms for telegraph and telephone poles is a very simple operation. It consists merely in shaping into form, by the use of machinery, the raw material purchased in the form of squares of the proper size, and by boring holes for insulator pins. North Carolina pine is the only wood reported for these products. The average price paid was $14.66 per M, or $2.55 above the average cost of this wood used in the State by all manufacturers. The total was 2,800,000 feet, and was less than three-fourths of 1 per cent of all the yellow pine manufactured by the wood-using industries of North Carolina.

TABLE 21.—CROSS-ARMS (TELEPHONE AND TELEGRAPH).

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
North Carolina pine	2,816,000	$ 14.66	$ 41,282.54	.7

PIPES, MINE ROLLERS, AND PULLEYS.

Table 22 shows a practical use for black gum, which until recently was considered of little value for manufacturing purposes. It is cheaper than maple and has largely displaced it for the manufacture of mine rollers, and is used with red gum in making pulleys. The annual quantity of black gum used in North Carolina for making these products is 2,500,000 feet, reported at an average price of $8.36 per M. This is the only class of manufacturers in the State reporting black gum as a raw material.

Pipes have been classified under this industry for convenience of tabulation, but have no relation to mine rollers and pulleys. These are smoking pipes and are articles made of the root of the kalmia, which is better known as mountain laurel. The laurel comes to the factory in the form of roots and burls, and costs about 25 cents per hundred pounds at the factory, which, reduced to the basis of board measure, makes the price paid approximately $10 per M feet, board measure.

TABLE 22.—PIPES, PULLEYS, AND MINE ROLLERS.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Black gum	2,500,000	$ 8.36	$ 20,900.00	100.00
Kalmia	22,000	10.00	220.00	100.00
Red gum	10,000	12.00	120.00	.04
Totals	2,532,000	8.39	21,240.00	------------

STORE AND OFFICE FIXTURES, MANTELS, ETC.

There is a class of work for inside trim for buildings which is of a higher grade than described under sash, doors, blinds, etc., and consists chiefly of carved moldings, mantels, grills, and cabinets. Twenty-two woods are used, as shown in Table 23, and it is the largest list of woods reported by any industry in North Carolina. Highest grades of lumber are used, and it is due to this fact that the manufacturers of fixtures pay more for their raw material than is paid by any other of the woodworking industries. The cheapest wood reported was hemlock at $12 per M feet, while Circassian walnut was the most expensive at $200.

Furniture makers paid $26.71 per M more for mahogany than was paid by this industry. Twenty per cent of the lumber used was grown outside of the State. The average price of the home-grown wood was $5.42 less per thousand feet than of that shipped in from other States. Hemlock, buckeye, butternut, and Circassian walnut are not reported used in any other industry.

4

TABLE 23.—STORE AND OFFICE FIXTURES, MANTELS, AND CABINETS.

Kind of Wood.	Grown in North Carolina.		Grown Outside of North Carolina.		Total Quantity of Raw Material Used Annually.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and white oak	812,000	$ 40.03	60,000	$ 60.00	872,000	$ 41.40	$ 36,104.36	.61
North Carolina pine	2,000	20.00	300,000	12.50	302,000	12.54	3,790.00	.07
Red and tupelo gum	260,000	29.42			260,000	29.42	7,649.20	1.07
Yellow poplar	217,000	32.41	15,000	20.00	232,000	32.41	7,300.56	.66
White pine	140,000	31.96			140,000	31.96	4,474.40	1.07
Chestnut	115,000	19.30			115,000	19.30	2,219.50	1.50
Yellow birch	80,000	42.18			80,000	42.18	3,374.40	15.60
Maple	50,000	31.50			50,000	31.50	1,575.00	1.20
Black walnut	31,000	66.13	10,000	70.00	41,000	66.43	2,750.25	6.90
Basswood	40,000	40.00			40,000	40.00	1,600.00	15.00
Ash	30,000	25.00			30,000	25.00	750.00	2.12
Cherry	27,000	50.00			27,000	50.00	1,350.00	93.10
Hemlock	25,000	12.00			25,000	12.00	300.00	100.00
Mahogany			24,000	132.50	24,000	132.50	3,180.00	37.30
Beech	20,000	40.00			20,000	40.00	800.00	12.90
Red cedar	20,000	40.00			20,000	40.00	800.00	13.80
Hickory	20,000	40.00			20,000	40.00	800.00	.18
Butternut	20,000	40.00			20,000	40.00	800.00	100.00
Cypress			15,000	30.00	15,000	30.00	450.00	.54
Sycamore			15,000	20.00	15,000	20.00	300.00	4.07
Buckeye	10,000	40.00			10,000	40.00	400.00	100.00
Circassian walnut			3,000	200.00	3,000	200.00	600.00	100.00
All others*			3,000	80.00	3,000	80.00	240.00	100.00
Totals	1,919.000	35.53	445,000	30.11	2,364,000	34.52	81,607.67	

*Includes only imported woods not mentioned.

MUSICAL INSTRUMENTS.

Seven woods are listed in the manufacture of musical instruments, as shown in Table 24. High-grade oak and black walnut, in equal quantities, head this list. Eighty-four per cent of the black walnut manufactured in North Carolina goes into musical instruments, and 54 per cent of the sycamore is so used. White pine is reported at the low price of $12 per M, its chief use being for crating material and organ boxes. Next to vehicle manufacture, musical instruments draw the largest comparative quantity of their wood from forests outside of North Carolina. The products are not varied, reed organs, cabinet organs, and pipe organs alone being manufactured.

TABLE 24.—MUSICAL INSTRUMENTS.

KIND OF WOOD.	GROWN IN NORTH CAROLINA.		GROWN OUTSIDE OF NORTH CAROLINA.		TOTAL QUANTITY OF RAW MATERIAL USED ANNUALLY.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
Red and white oak	500,000	$ 22.50		$	500,000	$ 22.50	$ 11,250.00	.34
Black walnut	100,000	40.00	400,000	40.00	500,000	40.00	20,000.00	84.60
Yellow poplar	300,000	20.00			300,000	20.00	6,000.00	.85
Sycamore	200,000	10.00			200,000	10.00	2,000.00	54.20
Chestnut			200,000	20.00	200,000	20.00	4,000.00	2.60
White pine	100,000	12.00			100,000	12.00	1,200.00	.76
Totals	1,200,000	20.38	600,000	33.33	1,800,000	24.70	44,450.00	

PLANKING FOR BOATS.

White cedar is more in demand by the builders of boats and launches, to be used as planking or siding, than any other wood required for that purpose. In North Carolina the stand of white cedar, from which this commodity can be manufactured, is being rapidly exhausted. Accordingly, this industry has become entirely a side line, the white-cedar shingle manufacturers producing all the boat planking made in North Carolina in 1909. The average price of cedar as given in Table 25 was $14.38. This being reported in terms of "log scale" indicates the high price this commodity brings on the market in a manufactured state. Shingles are not considered in this report, owing to their being included with cooperage stock, cross-ties, etc., in the annual report issued by the Bureau of Census in coöperation with the Forest Service. Exclusive of the material used for making shingles, therefore, 76 per cent of the white cedar going into manufactures in this State is utilized for boat siding.

TABLE 25.—BOAT PLANKING.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White cedar	800,000	$ 14.38	$ 11,504.00	76.2

EXCELSIOR.

Only three woods are reported in Table 26 for making excelsior in North Carolina—yellow poplar, white pine, and yellow pine, named in the order of quantity used. The total amount manufactured was 800,000 feet, purchased at an outlay of $6,352. The average price paid for this raw material was $8.30 per M feet, delivered at the factory in the form of billets and poles. The following table presents the available statistics for 1909:

TABLE 26.—EXCELSIOR.

Kind of Wood.	Raw Material Used Annually, and Grown in North Carolina.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White pine	300,000	$ 6.34	$ 1,902.00	2.29
Yellow poplar	300,000	10.00	3,000.00	.85
Yellow pine	200,000	7.25	1,450.00	.05
Totals	800,000	8.31	6,352.00	------------

WOODENWARE.

Candy, well, and water buckets, pails, tubs of various kinds, chop bowls, firkins, churns, ironing boards, bread boards, washboards, and other articles pertaining to household use are the principal products of the woodenware manufacturers of North Carolina. Six kinds of woods were reported at an average price of $17 per M. A total of 775,000 feet were manufactured, all grown in North Carolina. This industry uses less raw material than any other considered in this study. White cedar, which in North Carolina is commonly but improperly called juniper, headed the list in amount used, and it constituted 24 per cent of the wood demanded by this industry. The white poplar and white cypress noted in the table are known to the local trade by these names, but are in fact only the sapwood of yellow poplar and red cypress. They were recorded in this individual table by these local names in order to indicate to any one desiring to sell raw material for this class of manufactures the kind of wood desired. White cypress is used for confectionery buckets and other packages. It is especially demanded for this purpose, as experience has shown that this wood imparts no taste to the contents of the package. White ash is used for butter tubs and firkins, and 7 per cent of this wood manufactured in the State goes into these products.

TABLE 27.—WOODENWARE.

KIND OF WOOD.	RAW MATERIAL USED ANNUALLY, AND GROWN IN NORTH CAROLINA.			Percentage of Quantity Required by All Industries in State.
	Quantity, Feet b. m.	Average Cost per M bd. ft. Delivered at Factory.	Total Cost Delivered at Factory.	
White cedar	250,000	$ 20.00	$ 5,000.00	23.80
Yellow poplar	100,000	15.00	1,500.00	.28
(White) poplar	100,000	12.00	1,200.00	100.00
White ash	100,000	20.00	2,000.00	7.06
(White) cypress	100,000	15.00	1,500.00	100.00
White oak	100,000	15.00	1,500.00	.07
White pine	25,000	18.00	450.00	.19
Totals	775,000	17.00	13,150.00	

APPENDIX I.

USES OF THE DIFFERENT KINDS OF WOOD.

Some of the various uses for the many kinds of wood entering into manufacture in North Carolina are given in the list which follows.

ASH.

Axles,
Buckets,
Buggy bodies,
Felloes (Wagon),
Furniture,
Gears (Running),
Interior trimming,
Measures,
Tables (Dining),
Tables (Extension),
Tops (Wagon),
Wagons,
Woodenware.

BASSWOOD.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,
Interior trimming,
Tables,
Tables (Extension).

BEECH.

Bobbins,
Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,
Interior trimming,
Mantels,
Shuttles,
Skewers,
Spools.

BIRCH.

Bobbins,
Chairs,
Furniture,
Interior trimming,
Moldings (Fancy),
Rockers,
Showcases,
Skewers,
Stands,
Tables (Extension).

BLACK GUM.

Back bands,
Baskets,
Baskets (Fruit),
Baskets (Vegetable),
Cases (Berry),
Cases (Fruit),
Cases (Vegetable),
Crates (Vegetable),
Cases (Berry),
Cups (Quart),
Hoppers,
Implements (Agricultural),
Rollers (Log wagon),
Rollers (Mine),
Slack cooperage,
Trays.

BLACK AND YELLOW LOCUST.

Brackets (Pole),
Insulator pins.

BLACK WALNUT.

Cabinet work,
Coffins,
Fixtures (Bar),
Fixtures (Office),
Fixtures (Store),
Organs (Pipe),
Organs (Reed),
Showcases.

BOX ELDER.

Interior trimming.

BUCKEYE.

Cabinet work,
Fixtures (Office).

BUTTERNUT.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture (Inside of).

CIRCASSIAN WALNUT.

Cabinet work,
Fixtures (Office),
Fixtures (Store),
Interior trimming,
Moldings (Fancy).

CHERRY.

Cabinet work,
Fixtures (Office),

Fixtures (Store),
Furniture,
Interior trimming,
Mantels,
Moldings (Fancy),
Panels,
Pedestals,
Showcases,
Stands,
Tables (Library),
Tables (Parlor).

CHESTNUT.

Blocks (Base),
Blocks (Corner),
Boards (Wash),
Cabinet work,
Caskets,
Coffins,
Cradles,
Exterior trimming,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture,
Furniture (Mission),
Interior trimming,
Mantels,
Moldings (Stock),
Organs (Pipe),
Organs (Reed),
Panels,
Partition,
Pedestals,
Showcases,
Stair work,
Stands,
Tables,
Tables (Dining),
Tables (Library),
Tables (Sewing).

COTTONWOOD.

Interior trimming.

CUCUMBER.

Interior trimming.

DOGWOOD.

Bobbins.

ELM.

Baskets,
Baskets (Grape),
Baskets (Fruit),
Chairs,
Crates,
Hoppers,
Rockers,
Tops (Buggy),
Trays.

HARD MAPLE.

Bobbins,
Cabinet work,
Chairs,
Chairs (Reclining),
Desks (School),
Flooring,
Frames (Wagon bed),
Frames (Buggy box),
Furniture,
Moldings (Stock),
Panels,
Pedestals,
Piano stools,
Rockers,
Skewers,
Spools,
Stands,
Sticks (Picker),
Tables.

HEMLOCK.

Fixtures (Office),
Fixtures (Store),
Interior trimming.

HICKORY.

Axles,
Bobbins,
Buggies,
Carriages,
Carts,
Casing (Axle),
Chairs,
Fixtures (Office),
Fixtures (Store),
Handles (Axe),
Handles (Machinery),
Handles (Tool),
Picker sticks,
Rims,
Rockers,
Shuttles,
Singletrees,
Skewers,
Spokes,
Shafts,
Sulkies,
Trucks,
Wagons,
Wheels.

KALMIA.

Holders (Cigar),
Pipes (Tobacco).

MAHOGANY.

Cabinets (Music),
Cabinet work,
Fixtures (Office),
Fixtures (Store),
Furniture,

Interior trimming,
Mantels,
Moldings (Fancy),
Panels,
Pedestals,
Stands,
Showcases,
Tables (Extension),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Sewing).

NORTH CAROLINA PINE.

Balusters,
Baskets,
Blinds,
Boxes,
Boxes (Rough),
Brackets,
Buggy bodies,
Cabinet works,
Car siding,
Carriage bodies,
Casing,
Caskets,
Ceiling,
Coffins,
Corner strips,
Cornice work,
Crates (Vegetable),
Crates (Fruit),
Cross-arms,
Cultivators,
Diggers,
Door frames,
Doors,
Doors (Front),
Excelsior,
Factory flooring,
Fixtures (Store),
Fixtures (Office),
Flooring,
Furniture,
Grill work,
Hand rails,
Harrows,
Hoppers,
Interior trimming,
Mantels,
Newel posts,
Organs,
Panels,
Partition,
Planters,
Plows,
Poles,
Porch columns,
Sashes,
Seeders,
Shooks (Box),
Showcases,
Siding,
Slack cooperage,
Stair work,
Stock novelties,
Store fronts,
Spindles,
Window frames.

PERSIMMON.

Bobbins,
Shuttles,
Skewers.

POST OAK.

Brackets (Telephone pole),
Chairs,
Cupboards (Kitchen),
Doors,
Furniture,
Implements (Farming),
Interior trimming,
Safes (Kitchen),
Showcases,
Slack cooperage,
Tables,
Tables (Kitchen).

RED CEDAR.

Boxes (Clothes),
Casket snells,
Caskets,
Furniture,
Interior trimming,
Shingles.

RED CYPRESS.

Base blocks,
Base boards,
Casing,
Doors,
Exterior trimming,
Flooring,
Interior trimming,
Molding (Stock),
Partition,
Sash,
Shingles,
Washboards.

RED OAK.

Agricultural implements,
Base blocks,
Bedroom suits,
Brackets,
Brackets (Telegraph),
Brackets (Telephone),
Buffets,
Bureaus,
Cabinet work,
Cabinets (Kitchen),
Cabinets (Wall),
Cabinets (Parlor),

Cabinets (China),
Chairs,
Chairs (Reclining),
Chiffoniers,
Cradles,
Cultivators,
Cupboards,
Davenports,
Desks,
Doors,
Doors (Front),
Dressers,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture,
Harrows,
Hall racks,
Interior trimming,
Lamp stands,
Lounges,
Mantels,
Moldings (Stock),
Organs (Pipe),
Organs (Reed),
Partition,
Pedestals,
Piano stools,
Piano benches,
Planters,
Plows,
Rockers,
Safes (Kitchen),
Secretaries,
Seeders,
Showcases,
Sideboards,
Slack cooperage,
Sofas,
Stands,
Stair work,
Washboards.

RED AND TUPELO GUM.

Base boards,
Baskets (Grape),
Baskets (Fruit),
Baskets (Vegetable),
Baskets (Split),
Boxes (Berry),
Boxes (Plug tobacco),
Buggy bodies,
Cabinet work,
Cases (Berry),
Cases (Smoking tobacco),
Chairs,
Crates (Fruit),
Crates (Truck),
Cups (Quart),
Fixtures (Office),
Fixtures (Store),
Furniture,
Hoppers,
Interior trimming,
Mantels,
Mine rollers,
Moldings (Fancy),
Moldings (Stock),
Panels,
Pedestals,
Pulleys,
Rockers,
Stands,
Tables,
Tables (Card),
Tables (Parlor),
Tables (Sewing),
Trays.

SOFT MAPLE.

Baskets,
Crates (Fruit),
Crates (Truck),
Furniture,
Hoppers.

SPANISH OAK.

Blocks (Base),
Blocks (Corner),
Boards (Base),
Brackets (Telegraph pole),
Cabinets (Kitchen),
Chairs,
Cupboards,
Doors,
Flooring,
Furniture,
Furniture (Mission),
Implements (Agricultural),
Interior trimming,
Moldings (Stock),
Partition,
Piano benches,
Piano stools,
Rockers,
Safes (Kitchen),
Showcases.
Slack cooperage,
Sofas,
Stands,
Tables (Card),
Tables (Extension),
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Typewriter),
Tight cooperage.

SPRUCE.

Casings,
Doors,
Interior trimming,
Sash,
Stair work.

SYCAMORE.

Baskets,
Baskets (Grape),
Boxes,
Boxes (Plug tobacco),
Buckets (Candy),
Cabinet work,
Cases (Tobacco),
Fixtures (Office),
Fixtures (Store),
Furniture,
Mantels,
Organs (Pipe),
Organs (Reed),
Shooks (Box).

WHITE CEDAR.

Boat boards,
Casket shells,
Pails,
Shingles,
Ship planking,
Tubs (Wash),
Woodenware.

(WHITE) CYPRESS.

Buckets (Candy),
Pails,
Slack cooperage,
Woodenware.

WHITE PINE.

Blinds,
Boxes,
Boxes (Rough),
Cabinet work,
Casings,
Casket cases,
Cornices,
Doors,
Excelsior,
Exterior trimming,
Fixtures (Office),
Fixtures (Store),
Furniture,
Implements (Farming),
Interior trimming,
Ironing boards,
Organs (Pipe),
Organs (Reed),
Pails,
Sash,
Shelving,
Store fronts,
Washtubs,
Washboards.

WHITE OAK.

Bedroom suits,
Blocks (Base),
Blocks (Corner),
Blocks (Hub),
Boards (Base),
Bolsters (Wagon),
Brackets (Telephone pole),
Brackets (Telegraph pole),
Buckets (Water),
Buckets (Well),
Buggies,
Cabinet work,
Cabinets (China),
Cabinets (Parlor),
Carriages,
Carts,
Chairs,
Chairs (Reclining),
Chiffoniers,
Cradles,
Cultivators,
Davenports,
Doors,
Dressers,
Felloes,
Fixtures (Office),
Fixtures (Store),
Flooring,
Furniture (Mission),
Gears,
Hall racks,
Harrows,
Implements (Farming),
Interior trimming,
Lamp stands,
Lounges,
Measures,
Molding (Stock),
Panels,
Partition,
Pedestals,
Piano stools,
Piano benches,
Planters,
Plows,
Poles (Coupling),
Rolls,
Rockers,
Seeders,
Showcases,
Sideboards,
Sofas,
Spokes,
Spring bars,
Sulkies,
Tables (Card),
Tables (Extension),
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Serving),
Tables (Typewriting),
Tight cooperage,
Tongues (Wagon),
Veneers,

Wagons,
Wardrobes,
Wheels.

(WHITE) POPLAR.

Bed slats,
Boards (Cutting),
Boards (Wash),
Bowls (Chopping),
Cases (Fruit),
Crates (Truck),
Drawer bottoms,
Excelsior,
Furniture,
Mirror backs,
Packages (Vegetable),
Pails,
Tubs (Wash).

YELLOW POPLAR.

Baskets (Fruit),
Balusters,
Bed slats,
Blinds,
Boards (Cutting),
Boards (Wash),
Bowls (Chopping),
Boxes,
Boxes (Rough),
Boxes (Tobacco),
Brackets,
Buckets,
Buggy bodies,
Cabinet work,
Cabinets (Kitchen),
Carriage bodies,
Cases (Fruit),
Cases (Smoking tobacco),
Cases (Vegetable),
Cases (Casket),
Casing,
Caskets,
Ceiling,
Chairs,
Coffins,
Commodes,
Cornices,
Cupboards (Kitchen),
Cups (Berry),
Drawer bottoms,
Excelsior,
Fixtures (Office),
Fixtures (Store),
Furniture,
Hand rails,
Lamp stands,
Mantels,
Mirror racks,
Molding (Stock),
Newel posts,
Organs (Pipe),
Organs (Reed),
Pails,
Piano stools,
Porch columns,
Rockers,
Safes (Kitchen),
Sash,
Showcases,
Siding,
Slack cooperage,
Spindles,
Spools,
Stands,
Store fronts,
Tables,
Tables (Kitchen),
Tables (Library),
Tables (Parlor),
Tables (Sewing),
Veneers,
Wagon beds,
Wagon panels,
Wagon seats,
Wagon tops,
Wainscoting.

ALL OTHERS.

Cabinet work,
Interior trimming,
Mantels,
Panel work.

APPENDIX II.

WOOD MANUFACTURERS OF NORTH CAROLINA.

Concerns giving detailed information of their particular line of manufacture, from which the tables given in this report were compiled, are shown in the following list of names and addresses. Those manufacturing several products classified under different industries will appear in the list of firms named under more than one industry. This was explained previously in discussion of Table 5.

BOXES AND CRATES.

Butters Lumber Co.	Boardman.
Interstate Cooperage Co.	Belhaven.
Harrison Wagon Co.	Cary.
Hill & Daniel	Denton.
Carolina Veneer Co.	Elizabeth City.
National Box Co.	Elizabeth City.
Fayetteville Woodenware Co.	Fayetteville.
West Lumber Co.	Fayetteville.
Dudley Lumber Co.	Granite Falls.
Oettinger Buggy Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
Greenville Lumber and Veneer Co.	Greenville.
Warlick Lumber Co.	Gilkey.
R. H. Southerland	Henderson.
Corbitt Buggy Co.	Henderson.
Henderson Mfg. Co.	Henderson.
Hutton & Bourbonnais	Hickory.
High Point Buggy Co.	High Point.
Tomlinson Chair Mfg. Co.	High Point.
J. M. Bernhardt	Lenoir.
Cahill Chair and Lumber Co.	Madison.
Magnolia Mfg. Co.	Magnolia.
White Furniture Co.	Mebane.
Kincaid Bros. Lumber Co.	Mocksville.
Morganton Mfg. Co.	Morganton.
Mount Airy Mantel and Table Co.	Mount Airy.
G. S. Waters & Son	New Bern.
Wilson Lumber and Milling Co.	North Wilkesboro.
E. E. Wollott	Odell.
Plymouth Lumber Co.	Plymouth.
W. M. Carroll	Raleigh.
J. A. Love & Co.	Red Springs.
J. H. Walker & Co.	Reidsville.
J. A. Ritchie	Ritchfield.
Parker Lumber Co.	Roaring River.
Sanford Mfg. Co.	Sanford.
Selma Lumber Co.	Selma.
S. F. Stevens	Spring Hope.
Imperial Furniture Co.	Statesville.
Bell-Cantwell Lumber Co.	Wilmington.
Lingo Box Co., Inc.	Wilmington.
Wynnewood Lumber Co.	Wilmington.
W. L. Russell Shook and Lumber Co.	Wilson.
B. F. Huntley Furniture Co.	Winston-Salem.
J. E. Shelton Box Co.	Winston-Salem.

CHAIRS.

Ashboro Chair Co.	Ashboro.
Randolph Chair Co.	Ashboro.
Newberry Bros. & Cowell	Dunn.
George Bailey	Elkin.
Overman Chair Works	Gibsonville.
Best Chair Co.	High Point.
Southern Chair Co.	High Point.
Brush Creek Bending Co.	Jordan.
Lenoir Furniture Co.	Lenoir.
Moore Furniture Co.	Lenoir.
Liberty Chair Co.	Liberty.
Cahill Chair and Lumber Co.	Madison.
Continental Chair Mfg. Co.	Mebane.
Harris Chair Co.	Mellboro.
Mocksville Chair Co.	Mocksville.
Alexander Chair Co.	Taylorsville.
Bard Lumber and Mfg. Co.	Thomasville.
Cates Chair Co.	Thomasville.
Cramer Furniture Co.	Thomasville.
Queen City Co.	Thomasville.
Standard Chair Co.	Thomasville.
Thomasville Chair Co.	Thomasville.
Dixie Chair Co.	Trinity.
Parsons Chair Co.	Trinity.
Wadesboro Furniture Co.	Wadesboro.
Walkertown Chair Co.	Walkertown.
Forsyth Chair Co.	Winston-Salem.

COFFINS, CASKETS, AND CASKET CASES.

Charlotte Casket Co.	Charlotte.
Woodland Mfg. Co.	George.
Rankin Coffin and Casket Co.	High Point.
Kelford Mfg. Co.	Kelford.
Rockwell Furniture Co.	Rockwell.
Hearne Bros. & Co.	Whitakers.
Turner-White Coffin Co.	Wilkesboro.

CROSS-ARMS.

J. C. Bruton & Co.	Fayetteville.
The W. & N. Absher Co.	North Wilkesboro.
Roaring River Mfg. Co.	Roaring River.

EXCELSIOR.

High Point Excelsior Co.	High Point.
Lexington Excelsior Co.	Lexington.
Salem Excelsior Co.	Winston-Salem.

FARMING IMPLEMENTS.

Ashboro Wheelbarrow Mfg. Co.	Ashboro.
Globe Plow Co.	Greensboro.
Wayne Agriculture Works	Goldsboro.
Raleigh Iron Works Co.	Raleigh.
A. G. Cox Mfg. Co.	Winterville.

FLOORING, CEILING, SIDING, ETC.

Aberdeen Sash and Blind Co.	Aberdeen.
Woodland Mfg. Co.	Albemarle.
Alma Lumber Co.	Alma.
W. M. Jones	Asheville.

Belhaven Lumber Co.	Belhaven.
Reddick & Windley	Belhaven.
Bridger Co.	Bladenboro.
Butters Lumber Co.	Boardman.
Waccamaw Lumber Co.	Bolton.
East River Lumber Co.	Burgaw.
Burlington Lumber Co.	Burlington.
J. L. Leary	Casar.
Bynum Lumber Co.	Cameron.
Currie & McQueen	Carthage.
Williamson & Brown Land and Lumber Co.	Cerro-Gordo.
Chadbourn Mfg. Co.	Chadbourn.
Brown Lumber Co.	Chadbourn.
Carolina Mfg. Co.	Charlotte.
Styer's Sash and Door Shops	Cherryville.
Clarkton Planing Mill Co.	Clarkton.
J. C. Taylor	Como.
Hill & Daniel	Denton.
Snider's Lumber Co.	Denton.
J. R. Smith Co.	Dixon.
Goldsboro Lumber Co.	Dover.
Huffman & Mull	Drexel.
Southern Lumber Co.	Dunn.
Dupree Massengill Lumber Co.	Dunn.
Durham Lumber Co.	Durham.
Branning Mfg. Co.	Edenton.
Rock Ford Mfg. Co.	Elm City.
Foreman-Blades Lumber Co.	Elizabeth City.
Kramer Bros. & Co.	Elizabeth City.
Parker & Thorn	Enfield.
H. Freeman & Son	Ether.
Fayetteville Planing Mill Co.	Fayetteville.
Ashboro Lumber and Mfg. Co.	Fayetteville.
Cumberland Lumber Co.	Fayetteville.
McDiarmid Lumber Co.	Fayetteville.
Regal Mfg. Co.	Forest City.
Dove Lumber Co.	Floral Springs.
Page Co.	Gastonia.
Woodland Mfg. Co.	George.
J. W. Jessup	George.
Warlick Lumber Co.	Gilkey.
Pitts & Giles	Glen Alpine.
J. D. Pitts	Glen Alpine.
Broadway Lumber Co.	Glaresville.
Enterprise Lumber Co.	Goldsboro.
Walker & McAdams	Graham.
Thaw-Clapp Lumber Co.	Greensboro.
Cape Fear Mfg. Co.	Greensboro.
Guilford Lumber Mfg. Co.	Greensboro.
South Atlantic Lumber Co.	Greensboro.
E. E. Bain & Son	Greensboro.
Brooks Mfg. Co.	Greensboro.
Pitts & Monroe	Greensboro.
Pitts Lumber and Mfg. Co.	Greenville.
Bennett Bros.	Hendersonville.
Albemarle Lumber Co.	Hertford.
Hutton & Bourbonnais	Hickory.
Hickory Mfg. Co.	Hickory.
Snow Lumber Co.	High Point.
Suffolk Lumber Co.	Jacksonville.
Jacksonville Lumber Co.	Jacksonville.
Moore Lumber Co.	Jonesboro.

D. B. Sasser	Kenly.
Kernersville Mfg. Co	Kernersville.
Lattimore Lumber Co	Kingsdale.
Kingsdale Lumber Co	Kingsdale.
Lenoir Woodworking Co	Lenoir.
Eagle Lumber Co	Lexington.
Little River Lumber Co	Linden.
Magnolia Mfg. Co	Magnolia.
L. T. Cottingham	Maxton.
United Lumber Co	Maxton.
Nelson Cooper Lumber and Furniture Co	Mebane.
H. A. Rankin	Mints.
Kincaid Bros. Lumber Co	Mocksville.
Ray Lumber Co	Moltonville.
Monroe Mfg. Co	Monroe.
Mooresville Furniture Lumber Co	Mooresville.
Snow Lumber Co	Mount Gilead.
Munger & Bennett	New Bern.
Pine Lumber Co	New Bern.
Broaddus & Ives Lumber Co	New Bern.
Neuse Lumber Co	New Bern.
Gaither Mfg. Co	Newton.
Laus Lumber Co	Norlina.
Davis-Keith & Connelly	Northside.
Wilkesboro Mfg. Co	North Wilkesboro.
E. E. Wollott & Co	Odell.
Cohaire Lumber Co	Parkesburg.
Parsons Lumber Co	Parsons.
Brown-Shaw Lumber Co	Pembroke.
Pembroke Planing Mill Co	Pembroke.
Builders Lumber Co	Raeford.
Baker-Thompson Lumber Co	Raleigh.
R. D. Thompson	Richlands.
J. A. Ritchie	Richfield.
Messick Crate Factory	Rocky Point.
Carr Lumber Co	Rose Hill.
Rowland Mfg. Co	Rowland.
Long, Spencer & Co	Roxboro.
Oakwood Mfg. Co.	Rutherfordton.
Carpenter-Taylor Co.	Rutherfordton.
Graf-Davis-Collet Lumber Co	Salisbury.
C. M. Thompson	Salisbury.
C. H. Smith	Sanford.
Selma Lumber Co	Selma.
Shelby Woodworking Co	Shelby.
Montgomery Lumber Co	Spring Hope.
J. H. Saunders	Spring Hope.
Z. T. Wright & Sons	Star.
Sylva Lumber and Mfg. Co	Sylva.
Southern and Norfolk Junction Planing Mill Co	Thomasville.
Guilford Lumber Mfg. Co	Troy.
A. Cameron	Vass.
Frank Buele	Wallace.
Leight Bros	Walkertown.
Moss Planing Mill Co	Washington.
W. B. Walling	Washington.
House Mfg. Co	Weldon.
Whiteville Lumber Co	Whiteville.
Chadbourn Sash, Door and Lumber Co	Wilmington.
Hilton Lumber Co	Wilmington.
Bell-Cantwell Lumber Co	Wilmington.
Wynnewood Lumber Co	Wilmington.

C. M. & W. G. Wilson	Wilson's Mills.
W. W. Sims Co.	Wilson.
Fogle Bros. & Co.	Winston-Salem.
J. H. Phillips	Winston-Salem.
Miller Bros.	Winston-Salem.

FRUIT AND VEGETABLE PACKAGES.

Brown Lumber Co.	Chadbourn.
Wilkes Veneer Co.	Edenton.
Carolina Basket and Veneer Co.	Elizabeth City.
Fayetteville Lumber and Crate Mfg. Co.	Fayetteville.
Cabinet Veneer Co.	Greenville.
Greenville Lumber and Veneer Co.	Greenville.
Utility Mfg. Co.	Goldsboro.
Magnolia Mfg. Co.	Magnolia.
John T. Croom & Bro.	Magnolia.
Union Point Lumber Co.	New Bern.
James Love & Co.	Red Springs.
The Dixie Co.	Rose Hill.
Messick Crate Factory	Rocky Point.
Eureka Lumber Co.	Washington.
Lingo Box Co.	Wilmington.

FURNITURE.

Albemarle Furniture and Mfg. Co.	Albemarle.
Yorke Furniture Co.	Concord.
Cornelius Furniture Co.	Cornelius.
Styer's Sash and Door Shops	Cherryville.
Hill & Daniel	Denton.
Drexel Furniture Co.	Drexel.
The Branning Mfg. Co.	Edenton.
Wilkes Veneer Co.	Edenton.
Elkin Furniture Co.	Elkin.
Elkin Veneer and Mfg. Co.	Elkin.
W. S. Rich Furniture Mfg. Co.	Elkin.
H. Freeman & Sons	Ether.
Goldsboro Furniture Mfg. Co.	Goldsboro.
Gate City Furniture Co.	Greensboro.
Greensboro Furniture Mfg. Co.	Greensboro.
Martin Furniture Co.	Hickory.
Hickory Furniture Co.	Hickory.
Marsh Furniture Co.	High Point.
Hayworth Roll and Panel Co.	High Point.
Globe-Home Furniture Co.	High Point.
Atlantic Furniture Co.	High Point.
Kearns Furniture Co.	High Point.
Union Furniture Co.	High Point.
Welch Furniture Co.	High Point.
The Continental Furniture Co.	High Point.
Myrtle Desk Co.	High Point.
High Point Furniture Co.	High Point.
Columbia Furniture Co.	High Point.
Eagle Furniture Co.	High Point.
Southern Novelty Co.	High Point.
Lenoir Woodworking Co.	Lenoir.
Harper Furniture Co.	Lenoir.
Moore Furniture Co.	Lenoir.
Kent-Coffey Mfg. Co.	Lenoir.
Kent Furniture Co.	Lenoir.
Tate Mfg. Co.	Lenoir.
American Furniture Co.	Lexington.

Elk Furniture Co.	Lexington.
Lexington Upholstering Co.	Lexington.
Dixie Furniture Co.	Lexington.
Catawba Furniture Co.	Marion.
McDowell Furniture Co.	Marion.
Blue Ridge Furniture Co.	Marion.
The White Furniture Co.	Mebane.
Alton Mfg. Co.	Mebane.
Mocksville Furniture Co.	Mocksville.
Mooresville Furniture Co.	Mooresville.
Morganton Furniture Co.	Morganton.
Banner Mfg. Co.	Mount Airy.
Mount Airy Furniture Co.	Mount Airy.
National Furniture Co.	Mount Airy.
Mount Airy Mantel and Table Co.	Mount Airy.
Murphy Furniture Mfg. Co.	Murphy.
Oak Furniture Co.	North Wilkesboro.
Forest Furniture Co.	North Wilkesboro.
Oxford Furniture Co.	Oxford.
K. Nicholson	Pilot Mountain.
Ramseur Furniture Co.	Ramseur.
Skyland Furniture Shop	Skyland.
T. O. Spencer	Sophia.
North State Veneer Co.	Statesville.
Imperial Furniture Mfg. Co.	Statesville.
Kincaid Furniture Co.	Statesville.
Statesville Furniture Co.	Statesville.
Statesville Safe and Table Co.	Statesville.
Lambert Furniture Co.	Thomasville.
Thomasville Furniture Co.	Thomasville.
Wallburg Lounge Co.	Wallburg.
Waynesville Furniture Co.	Waynesville.
Oakland Mfg. Co.	Winston-Salem.
B. F. Huntley Furniture Co.	Winston-Salem.
Forsyth Furniture Co.	Winston-Salem.
Winston Furniture Co.	Winston-Salem.
J. E. Shelton Box Co.	Winston-Salem.
A. G. Cox Mfg. Co.	Winterville.

INSULATOR PINS AND BRACKETS.

The Blue Ridge Locust Pin Co.	Dillsboro.
J. C. Bruton	Fayetteville.
Clarence Call	North Wilkesboro.

KITCHEN SAFES, CABINETS, AND CUPBOARDS.

Alma Furniture Co.	High Point.
Kitchen Cabinet and Table Co.	High Point.
Marsh Furniture Co.	High Point.
Caldwell Furniture Co.	Lenoir.
Fitts-Crabtree Mfg. Co.	Sanford.

PIPES, PULLEYS, AND MINE ROLLERS.

Southern Roller, Stave and Heading Co.	Elizabeth City.
Boon & Thine	Fayetteville.
Putnam Pipe Co.	Phenoy.
Eureka Lumber Co.	Washington.

PLANKING FOR BOATS.

Ezzell Bros. & Co.	Sessoms.
Cain & Willis	Tarheel.
H. A. Bozart	Wade.

SASH, DOORS, BLINDS, ETC.

Aberdeen Sash and Blind Co.	Aberdeen.
Woodland Mfg. Co.	Albemarle.
Azalea Woodworking Co.	Asheville.
Wm. M. Jones	Asheville.
J. R. Smith Co. & Dixon	Ayden.
Reddick & Windley	Belhaven.
G. W. Anthony	Burlington.
Burlington Lumber Co.	Burlington.
Bryson City Pump Co.	Bryson City.
J. L. Leary	Casar.
Carolina Mfg. Co.	Charlotte.
W. J. M. Finger	Charlotte.
Styer's Sash and Door Shops	Cherryville.
Flay Lumber Co.	Cherryville.
Sells Lumber Co.	Concord.
Snider's Lumber Co.	Denton.
Huffman & Mull	Drexel.
Southern Lumber Co.	Dunn.
Durham Lumber Co.	Durham.
Branning Mfg. Co.	Edenton.
Parker & Thorn	Enfield.
Fayetteville Planing Mill Co.	Fayetteville.
Regal Mfg. Co.	Forest City.
Bush Creek Mfg. Co.	Franklinville.
The Page Co.	Gastonia.
Woodland Mfg. Co.	George.
Walker & McAdams	Graham.
Dudley Lumber Co.	Granite Falls.
Cape Fear Mfg. Co.	Greensboro.
Guilford Lumber Co.	Greensboro.
Shaw-Clapp Lumber Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
Hickory Novelty Co.	Hickory.
Hickory Mfg. Co.	Hickory.
Snow Lumber Co.	High Point.
Jonesboro Sash and Blind Co.	Jonesboro.
Lenoir Woodworking Co.	Lenoir.
Maxton Sash and Door Co.	Maxton.
Nelson-Cooper Lumber and Furniture Co.	Mebane.
Kincaid Bros. Lumber Co.	Mocksville.
Monroe Mfg. Co.	Monroe.
Mooresville Furniture Co.	Mooresville.
Morganton Mfg. and Trading Co.	Morganton.
J. A. Tesh	Mount Airy.
The Woodworking Co.	New Bern.
Gaither Mfg. Co.	Newton.
Laus Lumber Co.	Norlina.
Wilkesboro Mfg. Co.	North Wilkesboro.
Builders Lumber Co.	Raeford.
Baker-Thompson Lumber Co.	Raleigh.
Ellington Building Supply Co.	Raleigh.
Ellington Lumber Co.	Raleigh.
Carpenter, Taylor & Co.	Rutherfordton.
Oakwood Mfg. Co.	Rutherfordton.
C. M. Thompson Furniture and Woodworking Co.	Salisbury.
Graf-Davis-Collett Lumber Co.	Salisbury.
Sanford Sash and Blind Co.	Sanford.
Shelby Woodworking Co.	Shelby.
The Thompson-Branton Co.	Shelby.
Overcash Bros.	Statesville.
Sylva Lumber and Mfg. Co.	Sylva.

Southern and Norfolk Junction Planing Mill Co.	Thomasville.
Leight Bros.	Walkertown.
Moss Planing Mill Co.	Washington.
H. L. Moody	Waynesville.
House Mfg. Co.	Weldon.
R. A. Spainhaur	Wilkesboro.
W. W. Sims	Wilson.
C. M. & W. G. Wilson Lumber Co.	Wilson's Mills.
Chadbourn Sash, Door and Lumber Co.	Wilmington.
Fogle Bros. Co.	Winston-Salem.
Miller Bros.	Winston-Salem.
J. H. Phillips	Winston-Salem.

SHUTTLES, SPOOLS, BOBBINS, ETC.

Southern Bobbin, Shuttle and Spool Co.	Greensboro.
Warlick & Whisnant	Granite Falls.
J. Elwood Cox Mfg. Co.	High Point.
Linwood Mfg. Co.	Linwood.
Novelty Woodworks	Ramseur.
The Torrence Co.	Waynesville.
Winston Handle Co.	Winston-Salem.

STORE AND OFFICE FIXTURES, ETC., AND MUSICAL INSTRUMENTS.

Wm. M. Jones	Asheville.
Azalea Woodworking Co.	Asheville.
C. J. Smith & Son.	Ayden.
Burlington Lumber Co.	Burlington.
Cochrane Showcase Co.	Charlotte.
J. H. Wearn & Co.	Charlotte.
Durham Lumber Co.	Durham.
Guilford Lumber and Mfg. Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
High Point Molding Co.	High Point.
High Point Showcase Works	High Point.
Shipman Organ Co.	High Point.
Lenoir Woodworking Co.	Lenoir.
Monroe Manufacturing Co.	Monroe.
Mooresville Furniture Co.	Mooresville.
Will Carroll	Raleigh.
Carolina Woodworkers Co.	Raleigh.
Fogle Bros. & Co.	Winston-Salem.

TABLES, STANDS, AND EXTENSION TABLES.

Warlick & Whisnant Co.	Granite Falls.
Standard Table Co.	Greensboro.
The Pitt Lumber and Mfg. Co.	Greenville.
Alma Furniture Co.	Monroe.
Dalton Furniture Co.	High Point.
A. F. Ellison	High Point.
Garland Lumber Co.	High Point.
Kitchen Cabinet and Table Co.	High Point.
Marsh Furniture Co.	High Point.
Blue Ridge Bending Co.	Lenoir.
Mount Airy Mantel and Table Co.	Mount Airy.
Fitts-Crabtree Mfg. Co.	Sanford.
Sanford Mfg. Co.	Sanford.
Statesville Safe and Table Co.	Statesville.
Lee Mfg. Co.	Thomasville.
Parsons Chair Co.	Trinity.
W. Wood Mfg. Co.	Waynesville.

TOOL AND MACHINERY HANDLES.

Ashboro Wheelbarrow and Mfg. Co.	Ashboro.
French Broad Mfg. Co.	Barnard.
J. D. Pitts	Glen Alpine.
A. W. Vickery & Co.	Greensboro.
J. Elwood Cox Mfg. Co.	High Point.
Morganton Spoke and Handle Co.	Morganton.
Smith-Kiser Mfg. Co.	Rural Hall.
Thomasville Spoke Works	Thomasville.
The Torrence Co.	Waynesville.
Winston Handle Co.	Winston-Salem.

VEHICLES.

Ashboro Wheelbarrow and Mfg. Co.	Ashboro.
C. J. Smith & Son	Ayden.
The Tyson & Jones Buggy Co.	Carthage.
Harrison Wagon Co.	Cary.
Z. V. Johnson & Co.	Cary.
J. W. Jessups	George.
J. D. Pitts	Glen Alpine.
Oettinger Buggy Co.	Greensboro.
The John Flanagan Buggy Co.	Greenville.
Corbitt Buggy Co.	Henderson.
Henderson Mfg. Co.	Henderson.
Piedmont Wagon Co.	Hickory.
Beeson Mfg. Co.	High Point.
North Carolina Wheel Co.	High Point.
High Point Buggy Co.	High Point.
George T. Parker	Kelford.
Blue Ridge Bending Co.	Lenoir.
Piedmont Buggy Co.	Monroe.
Mount Airy Buggy Co.	Mount Airy.
S. E. Marshall & Co.	Mount Airy.
G. S. Waters & Son	New Bern.
Harris-Glenn Body Co.	Oxford.
Southern Wheel Co.	Oxford.
Taylor-Cannady Buggy Co.	Oxford.
Sanford Buggy Co.	Sanford.
Thomasville Spoke Works	Thomasville.
Washington Buggy Co.	Washington.
James H. Brown & Co.	Wilmington.
Hackney Wagon Co.	Wilson.
C. F. Nissen	Winston-Salem.
George E. Nissen	Winston-Salem.
S. J. Nisson	Winston-Salem.
Spack Bros.	Winston-Salem.
Winston Vehicle Co.	Winston-Salem.

WOODENWARE.

The Guerney Mfg. Co.	Bee Log.
Fayetteville Woodenware Co.	Fayetteville.
Morganton Spoke and Handle Co.	Morganton.

PUBLICATIONS

OF THE

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

BULLETINS.

1. Iron Ores of North Carolina, by Henry B. C. Nitze, 1893. 8°, 239 pp., 20 pl., and map. *Postage 10 cents.*

2. Building and Ornamental Stones in North Carolina, by T. L. Watson and F. B. Laney in collaboration with George P. Merrill, 1906. 8°, 283 pp., 32 pl., 2 figs. *Postage 25 cents. Cloth-bound copy 30 cents extra.*

3. Gold Deposits in North Carolina, by Henry B. C. Nitze and George B. Hanna, 1896. 8°, 196 pp., 14 pl., and map. *Out of print.*

4. Road Material and Road Construction in North Carolina, by J. A. Holmes, and William Cain, 1893. 8°, 88 pp. *Out of print.*

5. The Forests, Forest Lands and Forest Products of Eastern North Carolina, by W. W. Ashe, 1894. 8°, 128 pp., 5 pl. *Postage 5 cents.*

6. The Timber Trees of North Carolina, by Gifford Pinchot and W. W. Ashe, 1897. 8°, 227 pp., 22 pl. *Postage 10 cents.*

7. Forest Fires: Their Destructive Work, Causes and Prevention, by W. W. Ashe, 1895. 8°, 66 pp., 1 pl. *Postage 5 cents.*

8. Water-powers in North Carolina, by George F. Swain, Joseph A. Holmes and E. W. Myers, 1899. 8°, 362 pp., 16 pl. *Postage 16 cents.*

9. Monazite and Monazite Deposits in North Carolina, by Henry B. C. Nitze, 1895. 8°, 47 pp., 5 pl. *Postage 4 cents.*

10. Gold Mining in North Carolina and other Appalachian States, by Henry B. C. Nitze and A. J. Wilkins, 1897. 8°, 164 pp., 10 pl. *Postage 10 cents.*

11. Corundum and the Basic Magnesian Rocks of Western North Carolina, by J. Volney Lewis, 1895. 8°, 107 pp., 6 pl. *Postage 4 cents.*

12. History of the Gems Found in North Carolina, by George Frederick Kunz, 1907. 8°, 60 pp., 15 pl. *Postage 8 cents. Cloth-bound copy 30 cents extra.*

13. Clay Deposits and Clay Industries in North Carolina, by Heinrich Ries, 1897. 8°, 157 pp., 12 pl. *Postage 10 cents.*

14. The Cultivation of the Diamond-back Terrapin, by R. E. Coker, 1906. 8°, 67 pp., 23 pl., 2 figs. *Postage 6 cents.*

15. Experiments in Oyster Culture in Pamlico Sound, North Carolina, by Robert E. Coker, 1907. 8°, 74 pp., 17 pl., 11 figs. *Postage 6 cents.*

16. Shade Trees for North Carolina, by W. W. Ashe, 1908. 8°, 74 pp., 10 pl., 16 figs. *Postage 6 cents.*

17. Terracing of Farm Lands, by W. W. Ashe, 1908. 8°, 38 pp., 6 pl., 2 figs. *Postage 4 cents.*

18. Bibliography of North Carolina Geology, Mineralogy and Geography, with a list of Maps, by Francis Baker Laney and Katherine Hill Wood, 1909. 8°, 428 pp. *Postage 25 cents.*

19. The Tin Deposits of the Carolinas, by Joseph Hyde Pratt and Douglass B. Sterrett, 1905. 8°, 64 pp., 8 figs. *Postage 4 cents.*

20. Water-powers of North Carolina: An Appendix to Bulletin 8. *In Press.*

21. The Gold Hill Mining District of North Carolina, by Francis Baker Laney, 1910. 8°, 137 pp., 23 pl., 5 figs. *Postage 15 cents.*

22. A Report on the Cid Mining District, by J. E. Pogue, Jr. *In Press.*

ECONOMIC PAPERS.

1. The Maple-Sugar Industry in Western North Carolina, by W. W. Ashe, 1897. 8°, 34 pp. *Postage 2 cents.*

2. Recent Road Legislation in North Carolina, by J. A. Holmes. *Out of print.*

3. Talc and Pyrophyllite Deposits in North Carolina, by Joseph Hyde Pratt, 1900. 8°, 29 pp., 2 maps. *Postage 2 cents.*

4. The Mining Industry in North Carolina During 1900, by Joseph Hyde Pratt, 1901. 8°, 36 pp., and map. *Postage 2 cents.*

Takes up in some detail Occurrences of Gold, Silver, Lead and Zinc, Copper, Iron, Manganese, Corundum, Granite, Mica, Talc, Pyrophyllite, Graphite, Kaolin, Gem Minerals, Monazite, Tungsten, Building Stones, and Coal in North Carolina.

5. Road Laws of North Carolina, by J. A. Holmes. *Out of print.*

6. The Mining Industry in North Carolina During 1901, by Joseph Hyde Pratt, 1902. 8°, 102 pp. *Postage 4 cents.*

Gives a List of Minerals found in North Carolina; describes the Treatment of Sulphuret Gold Ores, giving Localities; takes up the Occurrence of Copper in the Virgilina, Gold Hill, and Ore Knob districts; gives Occurrence and Uses of Corundum; a List of Garnets, describing Localities; the Occurrence, Associated Minerals, Uses and Localities of Mica; the Occurrence of North Carolina Feldspar, with Analyses; an extended description of North Carolina Gems and Gem Minerals; Occurrences of Monazite, Barytes, Ocher; describes and gives Occurrences of Graphite and Coal; describes and gives Occurrences of Building Stones, including Limestone; describes and gives Uses for the various forms of Clay; and under the head of "Other Economic Minerals" describes and gives Occurrences of Chromite, Asbestos, and Zircon.

7. Mining Industry in North Carolina During 1902, by Joseph Hyde Pratt, 1903. 8°, 27 pp. *Postage 2 cents.*

8. The Mining Industry in North Carolina During 1903, by Joseph Hyde Pratt, 1904. 8°, 74 pp. *Postage 4 cents.*

Gives descriptions of Mines worked for Gold in 1903; descriptions of Properties worked for Copper during 1903, together with assay of ore from Twin-Edwards Mine; Analyses of Limonite ore from Wilson Mine; the Occurrence of Tin; in some detail the Occurrences of Abrasives; Occurrences of Monazite and Zircon; Occurrences and Varieties of Graphite, giving Methods of Cleaning; Occurrences of Marble and other forms of Limestone; Analyses of Kaolin from Barber Creek, Jackson County, North Carolina.

9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

Gives Mines Producing Gold and Silver during 1903 and 1904 and Sources of the Gold Produced during 1904; describes the mineral Chromite, giving Analyses of Selected Samples of Chromite from Mines in Yancey County; describes Commercial

Varieties of Mica, giving the manner in which it occurs in North Carolina, Percentage of Mica in the Dikes, Methods of Mining, Associated Minerals, Localities, Uses; describes the mineral Barytes, giving Method of Cleaning and Preparing Barytes for Market; describes the use of Monazite as used in connection with the Preparation of the Bunsen Burner, and goes into the use of Zircon in connection with the Nernst Lamp, giving a List of the Principal Yttrium Minerals; describes the minerals containing Corundum Gems, Hiddenite and Other Gem Minerals, and gives New Occurrences of these Gems; describes the mineral Graphite and gives new Uses for same.

10. Oyster Culture in North Carolina, by Robert E. Coker, 1905. 8°, 39 pp. *Postage 2 cents.*

11. The Mining Industry in North Carolina During 1905, by Joseph Hyde Pratt, 1906. 8°, 95 pp. *Postage 4 cents.*

Describes the mineral Cobalt and the principal minerals that contain Cobalt; Corundum Localities; Monazite and Zircon in considerable detail, giving Analyses of Thorianite; describes Tantalum Minerals and gives description of the Tantalum Lamp; gives brief description of Peat Deposits; the manufacture of Sand-lime Brick; Operations of Concentrating Plant in Black Sand Investigations; gives Laws Relating to Mines, Coal Mines, Mining, Mineral Interest in Land, Phosphate Rock, Marl Beds.

12. Investigations Relative to the Shad Fisheries of North Carolina, by John N. Cobb, 1906. 8°, 74 pp., 8 maps. *Postage 6 cents.*

13. Report of Committee on Fisheries in North Carolina. Compiled by Joseph Hyde Pratt, 1906. 8°, 78 pp. *Postage 4 cents.*

14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

Under the head of "Recent Changes in Gold Mining in North Carolina," gives methods of mining, describing Log Washers, Square Sets, Cyanide Plants, etc., and detailed descriptions of Gold Deposits and Mines are given; Copper Deposits of Swain County are described; Mica Deposits of Western North Carolina are described, giving Distribution and General Character, General Geology, Occurrence, Associated Minerals, Mining and Treatment of Mica, Origin, together with a description of many of the mines; Monazite is taken up in considerable detail as to Location and Occurrence, Geology, including Classes of Rocks, Age, Associations, Weathering, method of Mining and Cleaning, description of Monazite in Original Matrix.

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt, 1908. 8°, 176 pp., 13 pl., and 4 figs. *Postage 15 cents.*

Takes up in detail the Copper of the Gold Hill Copper District; a description of the Uses of Monazite and its Associated Minerals; descriptions of Ruby, Emerald, Beryl, Hiddenite, and Amethyst Localities; a detailed description with Analyses of the Principal Mineral Springs of North Carolina; a description of the Peat Formations in North Carolina, together with a detailed account of the Uses of Peat and the Results of an Experiment Conducted by the United States Geological Survey on Peat from Elizabeth City, North Carolina.

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina, compiled by Joseph Hyde Pratt, State Geologist, 1908. 8°, 45 pp. *Postage 4 cents.*

17. Proceedings of Drainage Convention held at New Bern, North Carolina, September 9, 1908. Compiled by Joseph Hyde Pratt, 1908. 8°, 94 pp. *Postage 5 cents.*

18. Proceedings of Second Annual Drainage Convention held at New Bern, North Carolina, November 11 and 12, 1909, compiled by Joseph Hyde Pratt, and containing North Carolina Drainage Law, 1909. 8°, 50 pp. *Postage 3 cents.*

19. Forest Fires in North Carolina During 1909, by J. S. Holmes, Forester, 1910. 8°, 52 pp., 9 pls. *Postage 3 cents.*

20. Wood-using Industries of North Carolina, by Roger E. Simmons, under the direction of J. S. Holmes and H. S. Sackett, 1910. 8°, 74 pp., 6 pl. *Postage 5 cents.*

VOLUMES.

Vol. I. Corundum and the Basic Magnesian Rocks in Western North Carolina, by Joseph Hyde Pratt and J. Volney Lewis, 1905. 8°, 464 pp., 44 pl., 35 figs. *Postage 32 cents. Cloth-bound copy 30 cents extra.*

Vol. II. Fishes of North Carolina, by H. M. Smith, 1907. 8°, 453 pp., 21 pl., 188 figs. *Postage 30 cents.*

Vol. III. The Physiography and Geography of the Coastal Plain Region of North Carolina. *In Press.*

Samples of any mineral found in the State may be sent to the office of the Geological and Economic Survey for identification, and the same will be classified free of charge. It must be understood, however, that NO ASSAYS, OR QUANTITATIVE DETERMINATIONS, WILL BE MADE. Samples should be in a lump form if possible, and marked plainly on outside of package with name of sender, post-office address, etc.; a *letter* should accompany sample and *stamp* should be enclosed for reply.

These publications are mailed to libraries and to individuals who may desire information on any of the special subjects named, free of charge, except that in each case applicants for the reports should forward the amount of *postage* needed, as indicated above, for mailing the bulletins desired, to the *State Geologist, Chapel Hill, N. C.*

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

JOSEPH HYDE PRATT, State Geologist

ECONOMIC PAPER No. 21

PROCEEDINGS

OF

THIRD ANNUAL DRAINAGE CONVENTION

HELD AT

WILMINGTON, NORTH CAROLINA

NOVEMBER 22 AND 23, 1910

AND

NORTH CAROLINA DRAINAGE LAW

(CODIFIED)

COMPILED BY

JOSEPH HYDE PRATT

MAY 20, 1775

RALEIGH
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS
1911

N557
N813e

GEOLOGICAL BOARD.

Governor W. W. Kitchin, *ex officio Chairman*	Raleigh.
Frank R. Hewitt	Asheville.
Hugh MacRae	Wilmington.
C. S. Vann	Edenton.
R. D. Caldwell	Lumberton.

Joseph Hyde Pratt, State Geologist	Chapel Hill.

NORTH CAROLINA STATE LIBRA

LETTER OF TRANSMITTAL.

Chapel Hill, N. C., April 5, 1911.

To His Excellency, Hon. W. W. Kitchin,

Governor of North Carolina.

Sir:—The Third Annual Drainage Convention held under the auspices of the North Carolina Drainage Association convened at Wilmington, N. C., on November 22, 1910. The work accomplished by this Convention and by its legislative committee is of such State-wide importance that I recommend that the proceedings of the Convention and the codified drainage law be published as Economic Paper No. 21 of the publications of the North Carolina Geological and Economic Survey.

Yours respectfully,

Joseph Hyde Pratt,

State Geologist.

CONTENTS.

PAGE

Introduction 7

Proceedings of the Convention 8

  Morning Session, November 22d 8

    Secretary's Report 9

    Appointment of Committees 10

  Afternoon Session, November 22d 11

  Night Session, November 22d 14

  Session, November 23d 15

    Report of Committee on Resolutions 16

    Report of Committee on Nominations 18

Tile Drainage, by J. R. Haswell, assistant drainage engineer, U. S. Department of Agriculture 21

North Carolina Drainage Law (Codified) 30

Decision of Supreme Court of North Carolina—Validity of Drainage Bonds. 57

PROCEEDINGS OF THE THIRD ANNUAL DRAINAGE CONVENTION HELD UNDER AUSPICES OF THE NORTH CAROLINA DRAINAGE ASSOCIATION

AND

THE NORTH CAROLINA DRAINAGE LAW

(CODIFIED).

COMPILED BY JOSEPH HYDE PRATT, STATE GEOLOGIST.

INTRODUCTION.

The interest in the drainage of North Carolina swamp and overflowed lands has continued to grow, and now there are but few sections of the coastal plain or Piedmont regions of the State that are not taking a deep interest in the reclamation of our swamp and overflowed areas. The North Carolina Drainage Law that was passed by the General Assembly of 1909 has been operative for nearly two years, and many drainage districts were and are being organized under the authority of this act. Until the passage of this act it had been almost impossible to carry on the drainage of any of the large areas of swamp or overflowed land, for there was no law that made it possible to continue the work when objections were made by any of the property-owners or to obtain outlets for the canals, nor was it possible to provide the revenue to carry on the work. The law of 1909 solved all these difficulties to a certain extent, but it was found after two years that it was necessary to amend the law in order to make it still more operative, and this question was one of the main ones discussed at the Convention.

There still seems to be considerable misunderstanding regarding the practicability of draining our swamp and overflowed lands, and in some localities, even after the reports of the drainage engineer have shown that the proposition of draining a certain area is feasible, men of considerable prominence and ability have spread the report that the proposition was impracticable and meant the loss of land to those entering the district. Even a casual study of the North Carolina Drainage Law will convince any one that it is impossible under the law to undertake the drainage of any district unless it is a feasible and practicable proposition.

The Third Drainage Convention was held under the auspices of the North Carolina Drainage Association, and delegates were invited from nearly all the counties and towns of eastern and central North Carolina, the delegates being appointed by the Governor, mayors of cities, and county commissioners.

The following counties were represented: Anson, Beaufort, Bladen, Brunswick, Buncombe, Cabarrus, Chowan, Columbus, Craven, Currituck, Duplin, Hyde, New Hanover, Onslow, Orange, Pamlico, Pender, Pitt, Robeson, Sampson, Tyrrell, Union, Wake, Warren, and Wilson.

PROCEEDINGS OF THE CONVENTION.

Morning Session, November 22, 1910.

The first meeting of the Convention was called to order on Tuesday morning, November 22d, at 10:30 o'clock, by Joseph A. Brown, President. Prayer was offered by the Rev. Dr. J. H. Foster, pastor of the First Baptist Church. The President then called upon Hon. Walter G. MacRae, Mayor of Wilmington, who welcomed the delegates and visitors to the city. He said in part:

> *Mr. President and Gentlemen of the Drainage Convention:* Some one has threatened this Convention with a speech from the mayor. Be of good cheer; for you shall realize during your stay that you are welcome without having to listen to an address upon the Cosmogony of the Universe. Taking the most selfish view of the situation, we want you here because the eastern part of the State will be most benefited by your deliberations; but there is no selfishness in the pleasure of receiving you. We wish that every man in the State would come to the city at least once a year; for there is not a nook or corner of North Carolina which we do not love. In this assembly you have men who have studied and who understand the science of drainage, and you have also men with the executive ability to organize any movement which may be determined upon, and to push it to a successful issue. Therefore, the citizens of Wilmington are proud to have you here, and we confidently look for the best results from your work.

The response to the address of welcome was made in behalf of the Association by President Brown. He thanked the mayor for his cordial words, and stated that each and every one of the delegates appreciated to the utmost the warm and friendly greeting. President Brown then referred to the importance of drainage work. He stated that North Carolina just now is entering upon an era of prosperity and advancement which renders imperative the reclamation of all swamp and waste lands in the State as soon as possible, so that they may be used for farming and other agricultural purposes. As an evidence of the value of drainage, President Brown stated that an amount of money was made in the Chadbourn District last year sufficient to defray the cost of draining an entire district. President Brown stated that what had been accomplished there could be done in other sections of the State. He concluded with an earnest appeal that the people awaken to a realization of the tremendous possibilities which the development of waste and swamp lands has in store for North Carolina.

After thanking the mayor again for his welcome in behalf of the city, President Brown stated that the Association was open for business.

The President then called for the report of the Secretary, Joseph Hyde Pratt.

SECRETARY'S REPORT.

I submit as the Secretary's report of the last meeting of the Convention and of the Association the report of the Convention as published by the North Carolina Geological and Economic Survey in Economic Paper No. 18, and, as we have plenty of these pamphlets for distribution, I do not believe that it is worth the time of the Convention to have that report read here.

The work of the Association during the past year has been very closely identified with that of the North Carolina Geological and Economic Survey, as the State Geologist is Secretary of the Association. No special meetings of the Association have been held during the past year, but the State Geologist has kept in close touch with all of the work that has been done in the State in connection with drainage, in the eastern North Carolina swamp lands and the overflowed lands of Piedmont North Carolina. It is gratifying to be able to report that these three drainage projects have been practically completed; two in eastern North Carolina, in Toisnot Swamp, Wilson County, and one in Beaufort County, and the other in Piedmont North Carolina on the overflowed lands of Clark's Creek. Five other drainage districts have been organized and final reports made, and in two instances the contracts have been let for the construction of the canals, and in the other three, contracts will be let within a short time. There are now, altogether, twenty-odd drainage districts, either organized or in process of organization, representing something over 500,000 acres. Several press bulletins have been published during the year relating to drainage work in the State, which have been generally distributed throughout North Carolina. It has been the object of the Association and of the Geological Survey to disseminate as widely as possible information regarding drainage work, what it will accomplish, and its value to those sections in which it is inaugurated.

The North Carolina Drainage Law has been published in pamphlet form and also very widely distributed. Requests have been received from Georgia, South Carolina, and Virginia for copies of the proceedings of our Association, and also copies of the North Carolina Drainage Law, from men who are interested in having as satisfactory a law passed for their States as we have in North Carolina. Similar requests for these pamphlets have also been received from many Congressmen, thus showing that many others are watching the work in North Carolina besides those in the State who are directly interested in it.

I believe we can say without boasting that a considerable part of the success of the drainage work in this State has been due to the work of the North Carolina Drainage Association.

The following committees were then appointed by the President:

Committee on Resolutions—Congressman John H. Small, chairman; Messrs. A. B. Croom, Jr., J. S. Mann, W. C. Stinson, and W. S. Privott.

Membership Committee—Joseph Hyde Pratt, chairman; Messrs. B. F. Keith, D. Boughnor, John Wilkinson, and J. T. Foy.

Committee on Nominations and Selecting Next Meeting Place—Congressman John M. Faison, chairman; Messrs. George T. Farrill, A. B. Lukens, Sellers, Layton, and Pratt.

The Secretary then delivered a message from Governor W. W. Kitchin, who had expected to attend the Convention, but was at the last moment detained in Raleigh. He sent his best wishes to the Convention and stated positively that he would be at the next Annual Drainage Convention.

President Brown then called on a number of members present for short talks. The principal points emphasized by each were as follows:

Mr. J. A. Taylor, President of the Chamber of Commerce, stated that he was impressed by the "commercial necessity which demands the reclamation of swamp lands in the State," and cited Chadbourn District as an instance of progressive development following the reclamation of lands which were once regarded as worthless.

Mr. John A. Wilkinson of Belhaven, a former President of the Association, spoke most interestingly of his experience with improved drainage projects now completed in the eastern part of the State. He is a resident of Belhaven, and the territory surrounding that town is the land which has been so wonderfully benefited through extensive canalization of the swamp regions. Mr. Wilkinson stated that the residents had made sufficient from their improved lands to defray the cost of drainage. "Why the people neglect the important matter of drainage is incomprehensible when the wonderful results obtained from the improved lands are considered," observed Mr. Wilkinson.

As an instance of what is being done, he said that 640 acres of virgin forest land had been reclaimed last year by the owners; this season, from the proper cultivation and drainage, the tract had yielded from 10 to 20 barrels of corn per acre. He stated that in his section three canals had been dug, varying in width from 20 to 35 feet and in depth from 6 to 8 feet. One of these canals is 11 miles long, and the amount of land drained by each of the three canals varies from 8,000 to 14,000 acres. The land in this territory is about 20 feet above sea-level and the approximate cost of dredging the canals was about 8 cents a cubic yard. The Albemarle Swamp, which is drained by the three canals, is nearly as large as the Dismal Swamp, and vast quantities of splendid land have been opened to cultivation. Not only have farms been improved through the installation of the canals, but fine roads have been built along their banks. Mr. Wilkinson stated that these reclaimed lands are being sold at $20 per acre, and that hundreds of persons are eagerly accepting the opportunity to secure tracts which almost yield crops without cultivation, so rich and fertile is the land. The effect of drainage upon the health of the community has been very salutary. The cost of digging the canals was shared equally by those in the drainage districts and the assessments were made on a pro rata basis, according to size of farms and values received from drainage. The bonds were issued for a thirteen-year period. During the first three years only interest charges are paid, but during the final ten-year period the principal is returned at the rate of 1-10 of the entire sum each year. In this manner the farmers are benefited from the beginning by proper drainage, and they scarcely feel the payments for the improvements.

Mr. William C. Stinson of New York City, who is interested in the Moyock Drainage District, made a very interesting talk on "The Swamp Lands of North Carolina as Profitable Investments."

The next speaker was Mr. Haswell, a representative of the U. S. Department of Agriculture, who made a most interesting talk on "Tile Drainage." This paper is printed at the end of the proceedings, on p. 21.

Following Mr. Haswell, Senator Brown introduced Senator Simmons, who, in a general way, spoke of the benefits to be derived from proper drainage, both as to the increased values of property and the very marked connection between good drainage and health and material prosperity.

AFTERNOON SESSION, TUESDAY, NOVEMBER 22, 1910.

The afternoon session convened at 3 o'clock, with President Brown presiding. "Drainage Problems and Drainage Bonds" was the subject of an interesting address by Joseph Hyde Pratt, State Geologist. After referring to the enormous problems which must be surmounted in land drainage, Mr. Pratt turned to the question of drainage bonds.

Following the talk of Mr. Pratt, the President introduced Mr. Lawrence Brett of the Brett Engineering Contract Company, of Wilson, N. C., who spoke briefly on the "Practical Work Under the North Carolina Drainage Law." Mr. Brett said that what was needed now was the education of the people to the advantages to be derived from draining their lands. He suggested certain minor changes in the law, and also suggested the appointment of a committee to draft the desired amendments to be submitted to the next Legislature.

Five-minute talks were then called for from representatives of the various drainage districts.

Mr. B. F. Keith of Wilmington spoke for Lyon Swamp District. He suggested an amendment whereby drainage districts may be formed in less time than is now required.

Mr. A. B. Lukens of Moyock, Currituck County, a member of the commission in the first drainage district organized under the new law, spoke for the Moyock Drainage District. He said that a canal 30 feet wide and 8 feet deep was begun some weeks prior to this Convention, and is progressing satisfactorily.

Dr. William C. Stinson of New York City said that it was proposed to make Dismal Swamp blossom like the rose by draining it.

Mr. Julian S. Mann of the board of commissioners in charge of the drainage of Mattamuskeet Lake, Hyde County, spoke very interestingly regarding that work.

Mr. F. F. Wetmore of Lumberton told of what has been done in Robeson County, where a drainage district has recently been formed. Mr. Wetmore thought there should be some change in the law requiring summons in person of all landowners not signing petition of the district. He said that in his county it was impossible to find all the landowners, owing to the fact that some of the land is in controversy. He suggested an amendment to the law, permitting service of summons by publication where the parties cannot be found.

Several of the speakers referred to lack of funds to make surveys of drainage districts. They suggested that the State should provide the Geological Survey Department with funds sufficient for the employment of an engineer to make surveys, and when the bonds are sold by the drainage districts pay back the amount expended for surveys, this money to be used in similar work elsewhere under the direction of the State Geologist.

The Secretary then read a telegram from Congressman Godwin, as follows:

> I find at last minute pressing official duties looking to the convening of Congress will prevent me from attending the Drainage Convention. I regret this, as I am heart and soul with you in the great effort to drain the swamp lands of our State. If present, I don't know that I could add to what will be said in behalf of drainage by the able speakers who have made a careful study of this question; but later on I will send you a letter giving my views of how to secure the early reclamation of our swamp lands.
>
> (Signed) H. L. GODWIN.

A letter was then read from Mr. J. O. Wright, General Drainage Engineer of the Trustees of the Internal Improvement Fund of the State of Florida, Tallahassee, Florida, under date of November 19, 1910, as follows:

Please convey to the Drainage Convention my most cordial greeting and best wishes. I had hoped to be present at this, the third annual meeting of the Association, but the Drainage Commission of Florida has decided to visit the Everglades the coming week and desire me to accompany them.

Although I have charge of large and important work here, I still have a deep interest in the drainage work of North Carolina; so much so that I contemplate establishing my legal residence in the good Old North State in the near future and spending the rest of my days in promoting the drainage and development of her rich agricultural lands.

If you desire to keep up with the procession, in the language of our worthy President, Mr. Brown, "You must keep walking." The State of Florida has established a drainage district embracing four and one-half million acres, and has let a contract for excavating upwards of 20,000,000 cubic yards of earth and stone. This work is now well under way; we have six dredges in operation and are removing almost 500,000 cubic yards per month.

The commencement of this work has had a wonderful effect on the price of the lands in the drainage district. Three years ago, the State sold a large amount of these lands in alternate sections at $2 per acre; during the past week it has closed a contract for 50,000 acres of the remaining sections of the lands previously sold, at $15 per acre. This is not a speculative deal, but an actual cash sale which shows an advance of 650 per cent in three years. This land is being resold by the purchasers in small tracts at a still higher price. No better illustration of the profitableness of reclaiming swamp lands by drainage can be found.

The lands in Eastern North Carolina are just as good as the lands in the Everglades; are well suited for growing staple crops and are within a short distance of the great markets of the country, and when drained and sufficiently advertised to attract public attention will, in my judgment, show even greater results.

With kind regards, I am, etc.,

Mr. C. G. Elliott, Chief of Drainage Investigations, United States Department of Agriculture, Washington, D. C., under date of November 17, 1910, wrote as follows:

In response to your invitation that some one from this office discuss the subject of tile drainage at the convention to be held at Wilmington November 22, I take pleasure in saying that Mr. J. R. Haswell, Assistant Drainage Engineer of this office, will be present and present a paper upon the improvement of farm lands by tile drainage. Mr. Haswell has become acquainted with some of the North Carolina lands in the design of drainage works for some of the test farms being conducted by the State Board of Agriculture. He has also had experience in such work in Kentucky, Virginia, and New York.

I have never been privileged to attend one of the State drainage conventions, but you may rest assured of my interest in the work of bettering the fertile lands of the State by approved and systematic drainage, and I wish you and those who are promoting such work a most profitable session.

Yours sincerely,

President Brown then introduced Congressman John H. Small, whom he referred to as a noted worker for waterways and drainage. Congressman Small made a splendid address which reflected his deep enthusiasm for drainage and waterway propositions. He discussed the value of proper drainage in relation to successful agriculture and stated that it has been recognized for more than one hundred years that lands must be properly drained to yield the best crops. Gratification was expressed by the speaker at the inauguration of the drainage movement by the United States Department of Agriculture. He says that not only do swamp lands need draining, but more lands, 6,000,000 acres of which are under cultivation, need better attention. Mr. Small entered a plea for a campaign of education among the people in the country sections, believing that it is only through education that ultimate results can be obtained.

A telegram was then read from Messrs. C. T. Bennett and C. E. Foy of New Bern, Craven County, N. C., as follows:

> "We are anxious to have the next Drainage Convention held at New Bern, and beg to ask your good influence to bring it here, with your headquarters at the Gaston House."

A telegram was also received from Mr. E. F. Lamb, President of the Chamber of Commerce of Elizabeth City, inviting the Association to hold its 1911 Convention in that city.

Mr. C. R. Vandecarr of New York, who is interested in swamp lands of Currituck County, sent the following telegram to the Convention:

> "Remember me gladly to all. Impress upon the Convention that the country is looking at the progress of North Carolina and talking about her progressiveness. Keep up the drainage work in the Old North State so that other States may have a good leader. I regret that I am unable to be present."

NIGHT SESSION, NOVEMBER 22.

On Tuesday night one of the most pleasant social features of the Convention transpired, when a "smoker" was held in the Chamber of Commerce rooms complimentary to the visitors. The "smoker" was arranged by the local committees. Mr. J. A. Taylor, President of the Chamber of Commerce, was toastmaster. There were about 200 persons present. President Taylor introduced Captain Earl I. Brown, United States engineer in charge of this district. Captain Brown told the assemblage something of the work that is being done in the district under his supervision under the United States Government, developing the waterways, improving the harbors, etc.

Mr. Kerr of Asheville, a member of the commission appointed to have charge of the Mattamuskeet Lake, was called upon by the toastmaster, and responded by telling something of the plans to drain not only the wet lands, but to take the water off the large area covered by the lake.

Mr. Iredell Meares, a prominent member of the local bar, responded to the call of the toastmaster in a very interesting short talk. He favored the Legislature at its next session authorizing the issuance of one million dollars in bonds for carrying forward this work. Mr. Meares would also like to see the State issue a million dollars in bonds for road work in the State.

Mr. Charles N. Evans, President of the Southern National Bank, responded for the bankers of the State, and declared that the farmers and business men could rest assured that the banks of the State would stand behind them.

Mr. B. F. Keith, Collector of Customs and one who is deeply interested in drainage, was next called upon, and said that he would be glad for the banks to come to the aid of the Lyon Swamp Drainage District, which is now advertising $40,000 worth of bonds. Mr. Keith spoke of the value of properly draining the lands, and also spoke in favor of good roads and the stock law.

There then followed addresses from Dr. John M. Faison, Congressman from the Third District; Mr. John A. Wilkinson of Belhaven; Mr. Joseph Hyde Pratt, and Senator F. M. Simmons, all of whom spoke briefly and interestingly about drainage work.

SESSION, WEDNESDAY, NOVEMBER 23.

The closing day of the Convention began at 9:30 o'clock on Wednesday morning, November 23d, when the delegates and a large number of townspeople assembled at the wharf between Market and Princess streets, and embarked upon a trip down the Cape Fear River on the Revenue Cutter *Seminole,* in charge of Capt. R. O. Crisp. Mr. William E. Springer was chairman of the boat committee and secured the services of this cutter. There were about 150 to 200 people who enjoyed the trip, and it was undoubtedly the pleasantest feature of the entire Convention. An elegant luncheon was served on the boat by Miss Eliza French and a number of assistants.

Immediately after the luncheon the concluding business session of the Convention was held, Mr. J. A. Brown, President, presiding.

The report of the Committee on Resolutions was submitted by Congressman John H. Small, of the Second North Carolina District, and the resolutions were unanimously adopted as follows:

REPORT OF COMMITTEE ON RESOLUTIONS.

This Association was organized for the purpose of promoting the drainage of wet and overflowed lands in North Carolina. There are in this State about 2,100,000 acres of unreclaimed swamp lands, and recent investigations have shown that at least 1,000,000 acres of this land may be profitably drained and reclaimed and subjected to cultivation, which lands are exceedingly fertile and productive. It is estimated that there are, in addition, perhaps 6,000,000 acres of land now under cultivation, which are insufficiently drained, and therefore uncertain in the production of crops. These facts present a problem of vital economic importance, the solution of which should appeal to the progressive spirit of all citizens.

It is admitted that drainage lies at the basis of successful agriculture in all the coastal plain region. Even if all the other factors necessary to the production of crops should exist, they cannot be grown upon wet lands, if the drainage is insufficient.

But the promotion of agriculture and the resultant prosperity of the individual farmer is not the only purpose which would be subserved. Drainage affects at least two vital public conditions. The conservation of the public health is now universally recognized as one of the chief functions of the State. The elimination of preventable diseases and the maintenance of normal health in the individual means vitality and efficiency which are essential to economic growth and progress in all lines. The drainage of our wet lands is the primary essential in the conservation of the public health. The people of the State are now pressing with unprecedented activity a movement for better highways. We are beginning to realize the important relation of good public roads to industrial growth and commercial expansion. No substantial and permanent highway can be constructed unless drainage is provided. Therefore, the public health and improved roads must wait upon drainage.

Every thoughtful citizen who is acquainted with our abundant resources must admit the necessity of attracting the right sort of settlers and home builders to our State. The tidewater section in North Carolina alone could provide homes for a population manifold in excess of the present number, and this added population would make for the greater prosperity of all. If we would attract home-seekers from the West and other desirable classes, we must offer them fertile lands, healthful conditions, good public roads, and good public schools. We are waging a successful crusade against ignorance, and it is within our power to provide the other essentials. We again repeat that drainage is a primary necessity, without which we can neither have the most productive lands, improved public health, better highways, nor the most desirable immigrants.

Resolved, That this Association request the Trustees of the State Agricultural and Mechanical College to make provision for a complete course of drainage engineering, and we commend to the young men of the State who are pursuing the study of agriculture, that they include in their course the essential problems of drainage. The President and Secretary of this Association are hereby directed to present a copy of this resolution, in person, if possible, to an early meeting of the Trustees of the A. and M. College.

Resolved, That this Association unreservedly commend the law authorizing the teaching of agriculture in the public schools, and especially in the rural districts, and we urge that some of the elementary principles connected with drainage be included in the agricultural course. To this end, we request the State Superintendent of Public Instruction to communicate with the county superintendents and, through them, with the teachers and district committees. The President and Secretary of this Association are directed to present this resolution to the State Superintendent of Public Instruction, and, through him, to the next session of the Legislature.

Resolved, That the Legislature be requested to enact legislation which shall relieve drainage bonds from all taxation, State, county, or municipal, for a period of fifteen years, provided the Legislature has the constitutional power to enact such a law. We refer to all bonds which may be issued during the next fifteen years. We are advertent to the inhibition against exemption from taxation of private property, but we submit that these bonds are excluded from such prohibited class. Drainage is more than a semi-public function. The public health and the construction of highways are exclusively within the province of the State, and both are substantially, if not entirely, subserved and promoted by drainage. Whatever is lost in the way of public revenue will be more than met by the increased value of lands added to the taxable property. We are constrained to regard this legislation of paramount importance in the successful organization and establishment of drainage districts throughout the State. The President and Secretary of the Association are directed to present this resolution to the next session of the Legislature, through the appropriate committees of both houses, and the President is authorized to appoint any additional members of the Association to join in the presentation and the promotion of such a law.

Resolved, That we urge the Legislature, at the next session, to enact a law authorizing the State Geological and Economic Survey to employ a competent drainage engineer, under the supervision of the State Geologist, who may be employed in visiting sections where drainage is contemplated, and confer with the landowners and make preliminary investigations, with a view to determining whether the said lands are susceptible of drainage, and within a limit of cost which would constitute a profitable investment, such investigation to be preliminary to the institution of a proceeding for the establishment of a drainage district, and that the necessary appropriation be made to meet the expenditure involved. We also urge the Legislature to appropriate a sufficient fund out of which may be paid the compensation of the drainage engineer, as provided in section 2 of the General Drainage Law of 1909, the said sum so advanced to be subsequently refunded.

The President and Secretary of the Association are directed to present this resolution at the next session of the Legislature, through the appropriate committees of both houses.

Resolved, That the State Department of Agriculture be earnestly requested to establish a demonstration farm at some point where the alluvial soil exists, with a view to demonstrating the productive capacity of the soil for the various crops.

The President and Secretary of the Association are directed to present this resolution to and continue to urge the same upon the attention of the Department of Agriculture.

Resolved, That this Association, on behalf of the people of North Carolina, express deep gratitude to the United States Department of Agriculture, and particularly to the Bureau of Drainage Investigations of that Department, for the most helpful assistance and coöperation with the State of North Carolina in the making of preliminary investigations and surveys, and for expert advice in the solution of many drainage problems. That the Secretary of the Association be directed to communicate a copy of this resolution to Hon. James Wilson, Secretary of Agriculture, and to Dr. C. G. Elliott, Chief of Drainage Investigations.

Resolved, That the thanks of the Association be tendered to the Secretary of the Treasury and the Chief of the Revenue Cutter Service for the courtesy extended in placing the revenue cutter "*Seminole*" at the disposition of the local committee, and providing a most delightful trip down the Cape Fear River and to various points of interest.

That we extend thanks to the Board of County Commissioners of New Hanover County for the use of the commodious and comfortable courtroom for the sessions of this Convention. That we also extend most grateful thanks to the Chamber of Commerce, the local committee and the citizens of Wilmington, for the many and delightful courtesies extended to the members of the Association, which have contributed in such large degree to a successful session and to the pleasure of the delegates. That we cannot forget the obligations which we owe to the press of the city of Wilmington and also of the State, in reporting the proceedings of this Convention. Publicity and agitation are necessary in furthering this great public movement, in which the press must be a most valuable auxiliary.

Respectfully submitted,

JOHN H. SMALL, *Chairman;*
A. B. CROOM, JR.,
J. S. MANN,
W. S. PRIVOTT,
W. C. STINSON.

Next was the report of the Committee on Membership. Mr. Joseph Hyde Pratt, Secretary, reported for this committee, stating that there were 115 delegates registered for this Convention, but that there were 200 in attendance, some neglecting to register. The registration books show that 23 counties were represented, with one person from Virginia and another from Georgia.

REPORT OF COMMITTEE ON NOMINATIONS.

The Committee on Nominations and Next Meeting Place next made its report through Dr. John M. Faison, Congressman from the Third District. Elizabeth City was recommended as the next place of meeting, the date being left with the Secretary and Treasurer; and officers for the ensuing year were recommended as follows:

President—J. A. BROWN, Chadbourn.

Secretary and Treasurer—JOSEPH HYDE PRATT, Chapel Hill.

Vice Presidents, one from each of the counties which have become interested in drainage:

Bladen County—O. L. Clark, Clarkton.
Beaufort—John Wilkinson, Belhaven.
Brunswick—Jackson Johnson, Town Creek.
Camden—W. G. Ferebee, Gregory.
Carteret—W. S. Chadwick, Beaufort.
Columbus—D. B. Boughnor, Chadbourn.
Craven—C. R. Thomas, New Bern.
Currituck—A. B. Lukens, Moyock.
Greene—D. M. Patrick, Snow Hill.
Guilford—E. W. Myers, Greensboro.
Harnett—H. L. Godwin, Dunn.
Jones—J. H. Bell, Polloksville.
New Hanover—B. F. Keith, Wilmington.
Hyde—J. S. Mann, Middletown.
Onslow—E. M. Koonce, Jacksonville.
Pamlico—G. T. Farnell, Bayboro,
Pasquotank—Dr. L. S. Blades, Elizabeth City.
Hertford—R. C. Bridger, Winton.
Chowan—S. C. Privott, Edenton.
Gates—A. P. Godwin, Gatesville.
Pender—A. B. Croom, Jr., Burgaw.
Bertie—Francis D. Winston, Windsor.
Robeson—J. B. Sellers, Lumberton.
Duplin—G. M. Houston, Chinquapin.
Sampson—George L. Peterson, Clinton.
Martin—Harry Stubbs, Williamston.
Cumberland—H. B. Downing, Cedar Creek.
Lincoln—R. M. Roseman, Lincolnton.
Tyrrell—John Pinner, East Lake.
Pitt—Burt James, Greenville.
Washington—Van Buren Martin, Plymouth.
Edgecombe—H. A. Gilliam, Tarboro.
Halifax—Paul Kitchin, Scotland Neck.
Perquimans—E. E. Everett, Hertford.
Anson—E. E. Barrett, Polkton.
Forsyth—A. H. Eller, Winston.
Rockingham—R. P. Richardson, Reidsville.
Iredell—James B. Armfield, Statesville.

This entire report was unanimously adopted.

A motion was made and seconded that the President of the Association should appoint a Legislative Committee to work for the adoption of the legislation recommended in the resolutions. This was unanimously passed. The President appointed the following committee:

John H. Small, Washington, N. C.
A. B. Lukens, Moyock, N. C.
John P. Kerr, Asheville, N. C.
Joseph Hyde Pratt, Chapel Hill, N. C.
J. S. Mann, Middletown, N. C.
Iredell Meares, Wilmington, N. C.
Lawrence Brett, Wilson, N. C.
S. S. Mann, Swan Quarter, N. C.
A. B. Croom, Jr., Burgaw, N. C.
John Wilkinson, Belhaven, N. C.

The following excerpt from the *Wilmington Morning Star*, November 23, 1910, gives briefly the work and objects of this Convention:

OUR DRAINAGE MOVEMENT.

The Convention of the North Carolina Drainage Association, which met in Wilmington yesterday, will serve to emphasize the importance of drainage from one end of the State to the other. The interest in the movement has greatly increased since its organization three years ago, and not only the swamp counties, but the Piedmont and even the mountain counties have representatives in attendance upon the Wilmington Convention. It is being realized that the mountain lands and the bottom lands of the Piedmont country also need drainage and reclamation in a great many instances, and after this Convention completes its work the question will assume even greater importance throughout the State than it has in the history of the Commonwealth. The papers all over North Carolina have contained articles on the North Carolina drainage movement and concerning the meeting of the Association in Wilmington, and even outside the State the matter has attracted a great deal of attention and created comment. The *Norfolk Virginian-Pilot* of Monday says:

"The North Carolina Drainage Association, which will meet in convention at Wilmington this week, is doing a great and valuable work for the Old North State. The primary object of this Association is to encourage and facilitate the reclamation by drainage of vast areas of swamp and water-soaked lands in different sections of the Commonwealth. Already thousands of acres of highly fertile but hitherto untillable lands have so been added to the State's arable area, while the various drainage schemes now under consideration embrace, in the aggregate, hundreds of thousands of additional acres. In addition to this, the Association's efforts are to be directed to draining properly areas now under cultivation, but improperly drained, and so to increase the productivity of such lands. The result is bound to be increased wealth and accelerated prosperity, not only for the sections immediately affected, but for the Commonwealth at large. In its effort to solve the reclamation problem North Carolina is setting an example which some of her

Southern sisters are already following and which all would do well to imitate. The matter is one which properly comes within the jurisdiction of the several States as such and which the several States as such should and are competent to handle."

One of the results of this Convention will be the organization of quite a number of drainage districts, provided for in an act passed by the General Assembly of North Carolina at its last session two years ago. This act enables communities or districts to coöperate in the organization of "drainage districts," which can issue bonds and thus finance their drainage projects. Otherwise, sufficient capital could not be secured in communities or by individuals to carry on drainage projects on a more extensive scale than could be undertaken by private individuals. It is a good law and will prove exceedingly valuable to the State, as owing to private and State ownership of lands the National Government cannot aid in these local projects.

Besides the importance of reclaiming fertile bottom and swamp lands and generally benefiting such lands as can utilize the drains and terracing, the drainage districts will put on the market a good class of securities at good interest. These drainage bonds will furnish good collateral for loans or investments by local capitalists and banks, while the projects generally will give employment to a large number of hands. Drainage is decidedly a progressive movement, and we are laying great store by it as a factor in developing eastern North Carolina.

TILE DRAINAGE.

By J. R. HASWELL, Assistant Drainage Engineer,
U. S. Department of Agriculture.

A year ago, at the Second Annual Drainage Convention, an address was made on the "Practical Results of the Drainage of Farm Lands," in which for illustration the profits to be derived from reclaiming or improving three 40-acre tracts were compared. The first was a gum swamp, the second an open marsh or pocoson, and the last a poorly drained farm. The estimates showed that the improved drained farm would clear over $10,000 in five years, and the reclaimed swamps less than one-half that amount. These comparisons show that the drainage of wet farm lands brings surer results and quicker returns.

In order to help North Carolina drain the swamps within its borders and to improve the creeks so that surface water will be taken off, the United States Department of Agriculture has taken up sixteen projects and spent $20,000. Thus far there have been twenty-one drainage districts formed. The area tributary to the outlet canals amounts to over 500,000 acres.

OUTLETS, OPEN DITCHES, AND UNDERDRAINAGE.

These large canals and open ditches remove the surface water and reduce flooding, but only take the soil water from a narrow strip of land along their banks. Their greatest use is to serve as outlets for farm drains which extend back and completely cover the wet areas. Open ditches take up considerable farm land, are hard to keep in repair, cause trouble with farm operations, and are a source of danger to live stock.

The inconveniences of open ditches may be avoided by underdrainage, either with blind ditches of poles or stone, or by the use of tile. The latter have given the best results, and actual data obtained from the Buncombe County State Test Farm show that they cost less, in some cases, than their inferior substitutes of brush and stone.

HISTORICAL.

Tile were first used in this country by John Johnston of Seneca County, N. Y., who had learned the art of underdrainage in Scotland and had assisted in its introduction in the British Isles. He laid his tile in this country 70 years ago, and these same tile are still in use. The Middle West has made the most rapid strides in farm drainage since the profits to be obtained from it have become known. Figures for the year 1908 show North Carolina to rank lowest in the production of drain tile for those States reported, the total value being less than $2,000, while Iowa produced over $2,000,000 worth. This shows that North Carolina does not fully appreciate the benefits of tile drainage.

HOW TILE ACT UPON THE SOIL.

The farmer is interested in two forms of soil water, capillary and gravitational. The gravitational water is that which drowns out the crops and the capillary water is that which is needed in the upper strata of soil for growing crops. If a piece of soil is removed bodily from the ground, the gravitational water runs out and leaves the capillary water behind. This water is held by capillary attraction as paint in a paint brush. Pipes of circular form and usually one foot in length are laid in the ground, end to end, and on such a grade that the water which leaks through the joints or openings between the tiles will flow down a free outlet at a lower point. Now, as the water near the tile runs through the joints into the interior of the pipe, the water from a higher level passes down through the pores in the soil to take its place. The movement is lateral as well as downward.

The removal of the surplus water from the spaces between the soil particles makes the soil firmer and not likely to be puddled. The wetting and drying of a well-drained soil makes the particles draw together and form in crumbs or small grains. When a soil which is wet most of the time is plowed, it forms clods. The change to a granular structure is one of the most important benefits of tile drainage, as from it are derived most of the other beneficial results which apply generally to all farm crops with the exception of rice and cranberries. The drawing of the separate particles of soil together into a crumb makes more pore space in the soil, which permits of the circulation of air. Plants will not grow in a soil devoid of free oxygen.

A wet soil will not heat up so early in the spring, and the evaporation of water from its surface will make it colder throughout the growing season. This lower temperature will hasten the effects of winter, and thus we see how drainage by drying the soil warms it and thereby materially lengthens the growing season. This is of special importance in mountainous districts and greatly affects crops.

Plant food is present in much larger quantities in a drained soil. The capillary moisture held in the soil produces a greater chemical activity, without removing the products of the chemical action. This applies to the natural breaking down of the soil particles and also to commercial fertilizer. The air which the drains cause to be drawn into the soil will oxidize the minerals present and also favor the increase and growth of soil organisms which are helpful to plant growth. Poor drainage is indicated by a mottled appearance of the soil. When the level of the ground water is lowered by drainage the plants send their roots deeper, and this larger range of root zone is of great help in time of drought. The plant can draw on more soil for its moisture, the improved structure of the soil holds more moisture, and evaporation of water from the surface of the ground is reduced.

When a wet soil freezes to any great extent it heaves. This raises the plant stalk and many of the small roots are held back and broken. Successive heaving will raise a shallow-rooted plant out of the ground. This action is most excessive in a clay soil such as the red clay hills in the Piedmont region of this State.

Much of the soil in the eastern part of the State is of a light sandy nature and washes easily. Drainage, together with proper agricultural operations, will prevent much of this washing. Tile drainage causes the ground to absorb a rainfall and then carries the water away in channels that cannot wash. Deep plowing is of great assistance, as a reservoir is thus formed in the soil which will hold water till it can seep through to the tile. By deep plowing is meant 8 or 10 inches. Greater depths than this can be obtained by using a subsoil plow which breaks up the lower foot and a half without bringing the raw material to the surface. Subsoiling is absolutely necessary in some few stiff soils if tile drainage is to be a success. Great care should be taken to subsoil when the ground is dry underneath, as in the fall of the year. The growing of green manures or the application of stable manure adds humus or organic matter to the soil which will greatly assist in absorbing a rainfall. Under proper drainage conditions a rainfall of 3 inches can all be taken up without any run-off. Terraces are used to some extent to reduce erosion, and they are an expense and inconvenience to the farmer. On the Transylvania State Test Farm the application of drainage and organic matter has made terracing unnecessary.

By draining the swamps malaria is reduced to a minimum in the community and in many cases entirely eradicated. Likewise, good drainage around the farm buildings improves the sanitary conditions greatly, the dry earth acting as a disinfectant, so that the farm animals as well as the farmer are less subject to disease.

Tile drainage, therefore, acts upon the soil as follows: By forming it into a granular or crumb-like structure it provides the soil with more oxygen, and the oxygen causes oxidization and other chemical activities which are necessary to plant growth. It warms the soil and thereby lengthens the growing season. It causes the plants to send their roots farther down, prevents heaving, and in sandy lands prevents washing. And, finally, it is conducive to better sanitary conditions.

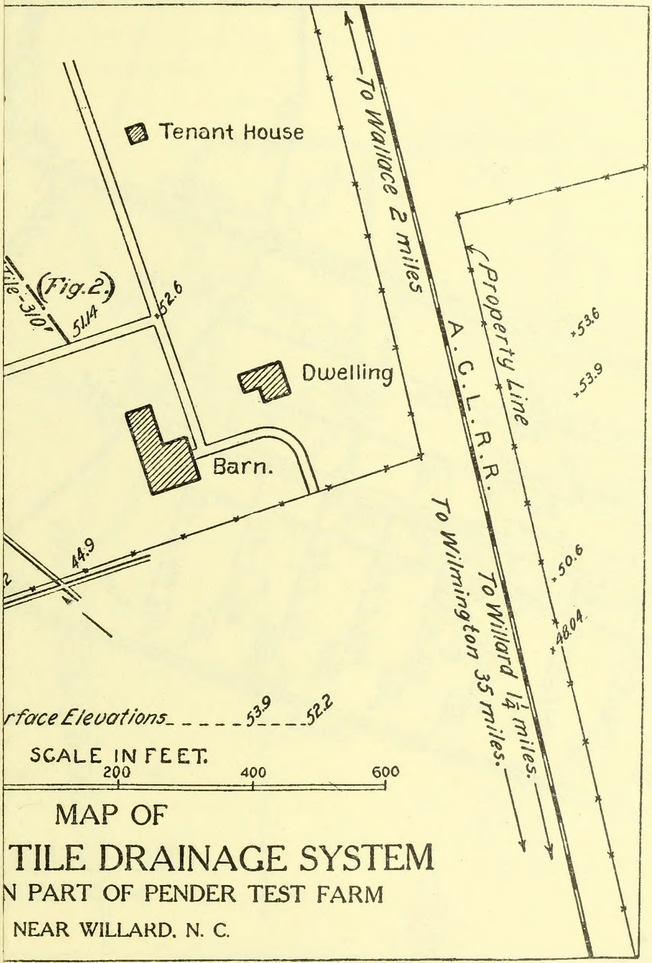
PROFITS OF TILE DRAINAGE.

Tile drainage acting in this manner upon the soil doubles and sometimes triples the yield per acre. Cleared land which has been too wet for anything but pasture in dry years can by drainage often be made the most productive on the farm. Usually, a farmer does not have to coöperate with his neighbors in farm drainage, and he thus avoids the endless controversy which sometimes is occasioned by attempted coöperation in larger work. The increased profits from the land are his own and he leaves a heritage for which his children will never cease to thank him, provided the work is well done.

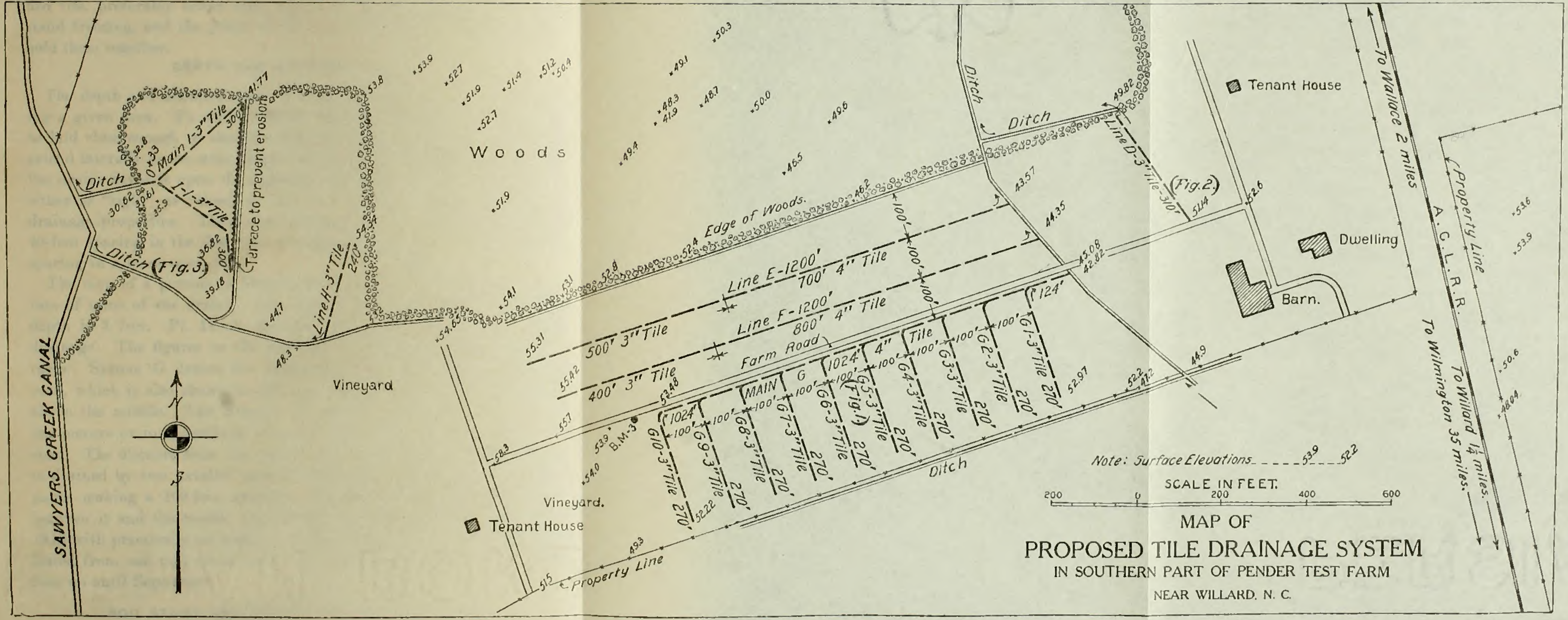
KIND OF TILE TO USE.

The most important items to be considered in tile drainage are the kind and durability of tile used. An important point in the selection of clay tile is the burning. They do not have to be vitrified, but every particle of clay should be burned. This makes the tile almost indestructible when in the ground.

E. P. 21, Plate I.



equal texture will modify the application. It would be advisable to



MAP OF
PROPOSED TILE DRAINAGE SYSTEM
IN SOUTHERN PART OF PENDER TEST FARM
NEAR WILLARD, N. C.

Frequent freezing and thawing, as at the outlet, is the most destructive agency at work. Spots of free lime are a great detriment, as the lime swells and splits up the tile. Porosity is not important, as practically no water passes through the walls of the tile, and, where the ground freezes down to the tile, porosity is undesirable. The best vitrified tile, preferably sewer pipe, should be used at the outlet to withstand freezing, and the joints of the sewer pipe should be cemented to hold them together.

DEPTH AND DISTANCE APART.

The depth and distance apart of drains determine the cost of draining a given area. To secure efficient drainage the lines of tile should be laid close enough so that the strip of land drained by one line will extend laterally to the strip drained by the other. The distance between the drains depends upon the tightness of the soil. Soils are spoken of either as "tight" or "close" or "loose" and open with respect to their drainage properties. These two extremes call for a 2-foot depth and 40-foot spacing in the first case as against a 4-foot depth and 300-foot spacing in a loose, open soil.

The map of a portion of Pender Test Farm (Pl. I) shows the location of some of the drains. The spacing is 100 feet and the average depth is 3 feet. Pl. II, A, shows a typical flat in need of uniform drainage. The figures on the map show the area relating to the pictures. System G drains the foreground and the main is along the road, which is also shown on the map, running across the picture just above the middle. The laterals run directly back from the front of the picture or in a northerly direction and connect to the main at the road. The distance from the road to the woods is 300 feet and the area is drained by two parallel lines dividing the distance into three equal parts, making a 100-foot spacing. The area north of the road, *i. e.*, between it and the woods, was planted in corn twice in the spring of 1910 with practically no results. The standing water in the foreground lasted from one rain to the next. In 1910 the field was in this condition up until September.

SOIL STUDY NECESSARY TO PLAN TILE SYSTEM.

Too great a depth in a tight soil renders the tile useless, and too shallow a depth in an open soil causes an extra cost on account of the closer spacing required. In a uniform soil, the deeper the tile are placed the farther out they will drain, up to a certain limit, which is determined by the resistance the soil offers to the passage of the water. In alluvial or stratified soils this does not hold, as various strata of unequal texture will modify the application. It would be advisable to change the depth and spacing in a small field to suit a change in the character of the soil. A joint structure in a subsoil clay renders it easily drained. A number of test pits, post holes, or auger borings should be made. A few pits are necessary in order to determine the structure, while borings can be used to determine the uniformity of the soil material throughout the area.

This study of the soil will save the farmer many dollars. A good instance of this is shown on the Buncombe Test Farm, where a line of tile a few hundred feet long and costing about $15 tapped a bed of gravel and drained approximately 10 acres. The gravel acted as a reservoir and allowed the water to seep out on the land below. When it was tapped the 3-inch tile ran full for quite a while, and the people thought of using it as a water supply, when it suddenly ceased flowing. Irregularities of soil in the upper surface of a clay subsoil will hold water and cause wet, quicksandy places in the loose, open soils of the coast plain counties. On the Pender Test Farm a ridge of clay held back the soil water and drowned out a pecan planting and much of the corn planted between the trees. A single line of 4-inch tile 310 feet long, laid 3½ feet deep through the ridge, will carry off the surplus water. This is shown in Pl. II, B, and on the map at line "D." The picture was taken from the windmill tower behind the superintendent's house and the camera was pointed northwest. The swale starts at the left of the picture and runs parallel to the road in the foreground. The two large pecans can be seen in the corn. The rest are dead or stunted. Line "H" runs through a similar swale. Single lines like these pay a high return on the investment.

TILE SYSTEMS.

In planning a system of drains the outlet is of most importance. This point is that to which all water from the drained area must eventually come, and on it the success of the system chiefly depends. The number of drainage districts throughout the State show that the outlet problem has been solved for a great area and all that is needed is for the farmer to realize his opportunities and to extend the system of drainage over his farm.

In rolling country the hillsides are generally thought to be naturally well drained and the long wet valleys furnish the only problems. A line of large tile laid along the lowest part of the draw will help out the natural drainage. Sharp turns and meanderings which occur in some valleys should not be followed, but straight lines joined by easy curves should be used. This will make the depth of the tile vary, but will reduce the length of line and increase the fall per 100 feet of tile.

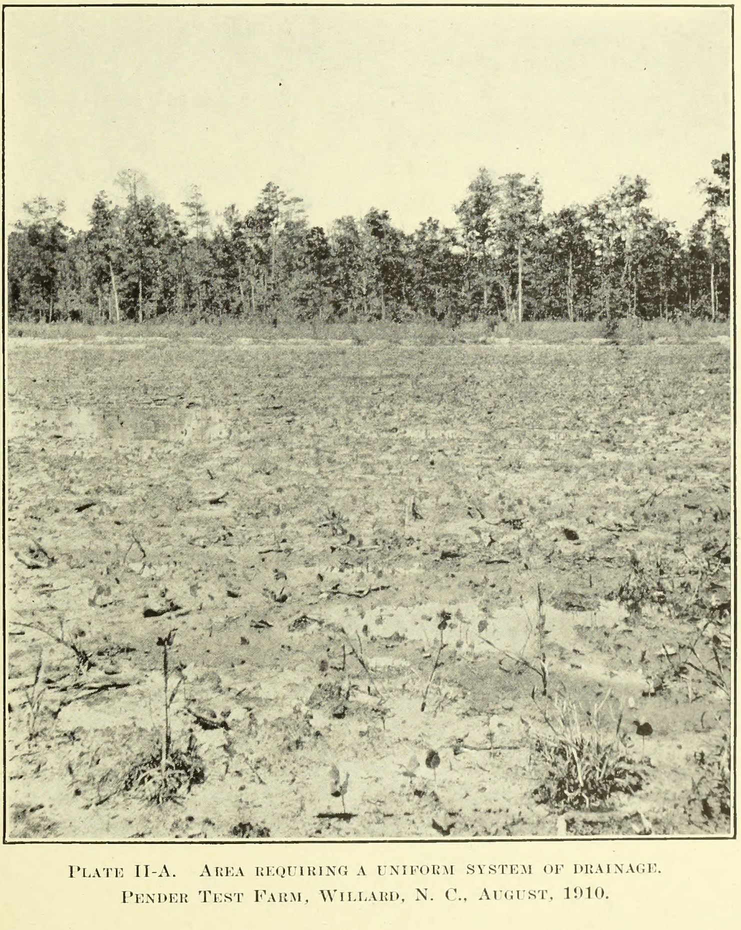


Plate II-A. Area requiring a uniform system of drainage.
Pender Test Farm, Willard, N. C., August, 1910.

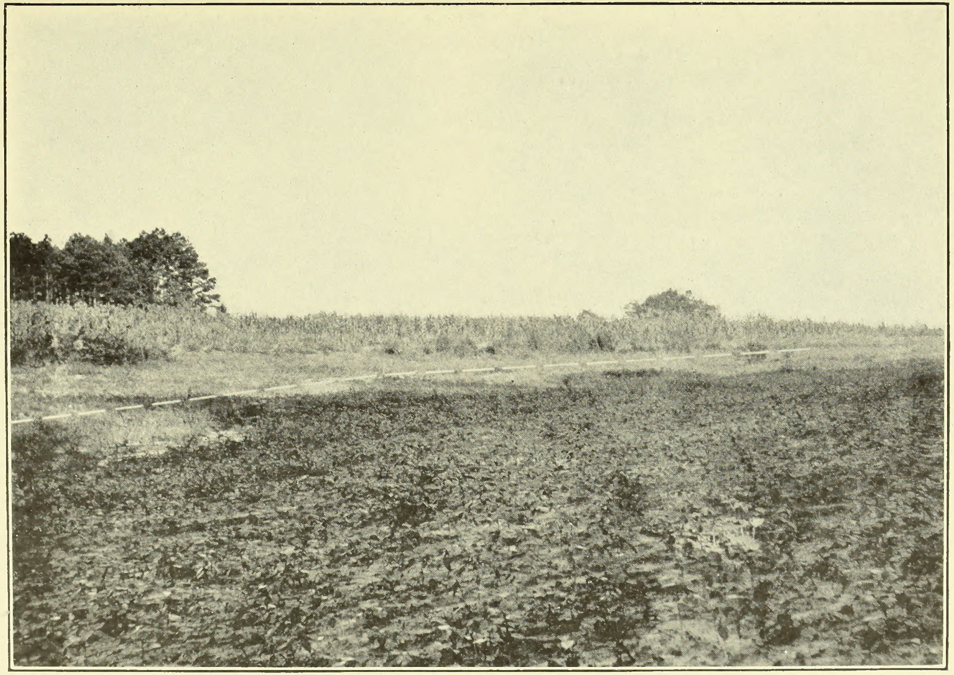


Plate II-B. Intercepting seep water from a hillside. Location of intercepting drain shown by broken white line. Pender Test Farm, Willard, N. C., August, 1910.

The valley may widen out so as to require several laterals parallel to the main in order to properly cover the area. This was the case in a narrow flat on the Red Crest Farm in Iredell County. On one side was a large open ditch, while the other side was too wet for use. Two, and in the wider part three, lines of tile were used. After the main has been located in the depression and the area tributary to it determined, the lateral drainage is planned.

RANDOM AND REGULAR TILE DRAINAGE.

This is done in two ways. The first is to locate branch lines to all sags, swales, ponds, etc., which are to be drained, without special regard to systematic work. This is called random field drainage. The second method is to supplement the primary network by constructing laterals parallel to each other at equal distances according to the requirements of the particular soil, acting on the theory that every part of the field requires equal drainage. The most economical system for thorough drainage is a system of parallel lines of sufficient length. This is easily seen when we consider that the soil in the neighborhood of a junction has two lines of tile working on it where only one is needed. Long parallel lines are seen at lines "E" and "F" on the map. The laterals in system "G" could not go the same way, as there was not fall enough in that direction.

As a general rule, drains should be laid up and down the slope, but in some cases a drain across the slope will accomplish the desired end at less cost. A case of this kind is where a low, wet flat receives seep water from a hill (Pl. III). A line of tile laid so as to intercept the seep water is all that is needed for drainage. Such a plan was used on the Pender Test Farm where an open ditch failed to go deep enough to intercept the water. Figure 3 was taken from near the outlet of System "I," looking east. The open ditch is along the edge of the corn and the whole slope below it was seepy. The line of tile is indicated by the dashed lines.

One frequently sees areas in a field which are surrounded by slightly higher land. This causes the water to settle toward the low spot and drown out the crop. A couple of collecting lines of 3-inch tile with a 4-inch main is all that is needed to stop the trouble. A location like this was used on the Edgecombe Test Farm. The stand of cotton over this drained sink was the best on the farm, and the net profit of the first year's crop on that area would pay for the cost of installing the tile. Previously, it had been planted and cultivated the same as the rest of the field and had drowned out each year, making a total loss for that area.

GRADES OF TILE DRAINS.

Grades should be set with a leveling instrument, by a competent engineer. The farmer should not attempt to plan a grade in any but rolling country. A farmer near here did some drainage work without a level, and when an engineer was called in to see why the tile would not work he found the outlet was one foot higher than the tile farther up the line.

It will be necessary to use flat grades on your level coastal plain, and with careful work in firm soils a grade of ½ inch per 100 feet will insure a flow, provided the lines are not too long. When possible, 2 inches per 100 feet is the best minimum grade for safe operation.

SIZE OF TILE FOR MAINS AND LATERALS.

The size of tile to be used is a point hard to determine, and it is impossible to cover all the features here. The mains act as outlets for the laterals and their sizes depend upon the necessary rate of removing the water through both drains. In excessive storms most of the run-off passes over the surface of the ground. The size also depends upon the area drained, the retentive qualities of the soil, and the grade on which the tile is laid. The main should not equal the combined capacity of the laterals, as they seldom, if ever, run full. Five-inch tile are the smallest that should be used for mains, while 6-inch are the smallest to which surface water can be directly admitted with safety. The sizes used on the Pender Test Farm were governed by the stock on hand.

There is a line of 3-inch tile 1,300 feet long on a farm in Edgecombe County. The area drained is 11 acres. The tile runs full through most all of the wet season, and is not as great a success as it might be. Five-inch tile would have added less than $20 to the first cost and would have more than paid for the extra expense. The smaller tile is much more likely to clog up and get out of line than a 5-inch tile.

The laterals act as collectors for the water, which the main will carry off. Their size is determined by practical operation and not by computed quantities of water to be removed. Very few 3-inch tile, and none smaller, should be used. This size is only practicable in a fairly open soil with laterals spaced 80 feet or closer. In heavy soils or where the laterals are spaced 100 feet or more, 4-inch tile should be used.

COST OF TILE DRAINAGE.

The cost of construction varies. On farms where tile in the valleys is to supplement good natural drainage on the hillsides, the cost may average only $8 per acre for the whole farm. Where uniform drainage

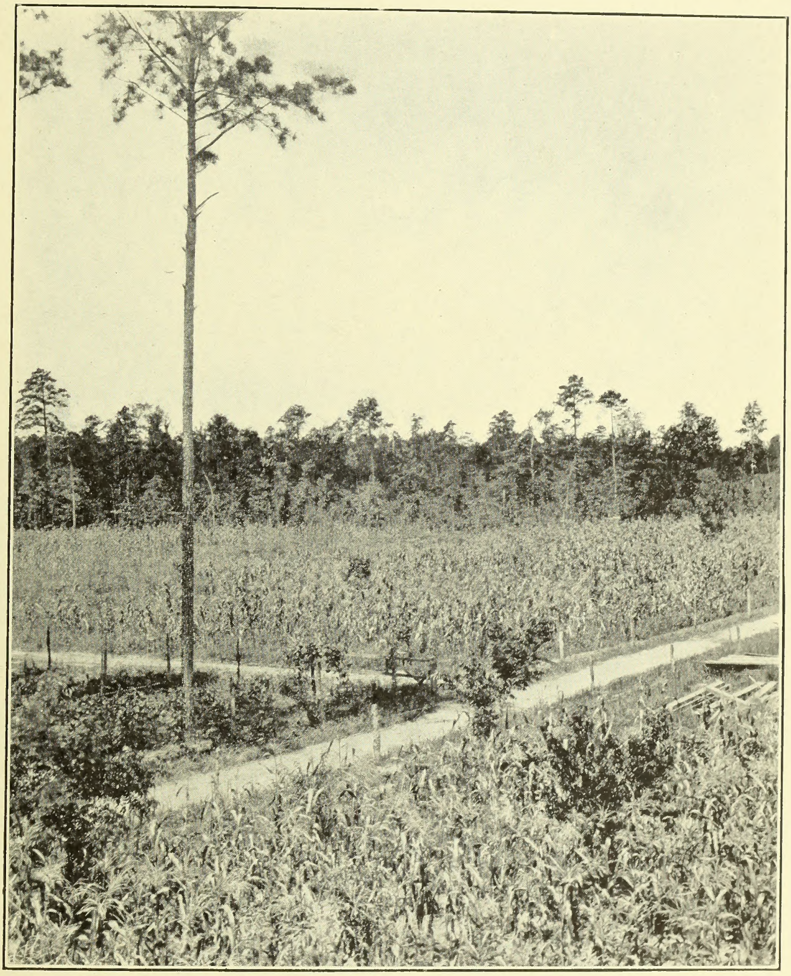


Plate III. Swale. Land requiring random drainage.
Pender Test Farm, Willard, N. C., August, 1910.

is required the cost may reach $30 per acre. The time of the year at which the ditching is done greatly governs the cost. The increased profits from drainage generally pay the cost of its installation in a few years, and as an investment an annual profit of 25 per cent is not uncommon.

It has been impossible to present here the entire field of tile drainage, but for more detailed information on the subject I would refer you to Farmers' Bulletin No. 187, "Drainage of Farm Lands," which will be furnished upon request to the United States Department of Agriculture. Information may also be found in books on drainage which may be obtained from any technical supply firm.

In regard to drainage as an investment, I wish, in closing, to quote an authority upon this subject, Mr. C. G. Elliott, Chief of Drainage Investigations, who writes:

> "The writer has known of many thousands of acres of land that have been drained, and has never known of an instance in which the money spent for drainage, when thoroughly done, did not pay a large return on the investment."

THE NORTH CAROLINA DRAINAGE LAW.

At the Third Annual Convention of the North Carolina Drainage Association which was held at Wilmington, North Carolina, on November 22 and 23, 1910, the principal topic of discussion was the modification of the North Carolina Drainage Law which would make it more effective and the drainage bonds more salable. At that Convention a legislative committee was appointed, composed as follows: John H. Small, Washington, N. C.; A. B. Lukens, Moyock, N. C.; J. S. Mann, Middletown, N. C.; Lawrence Brett, Wilson, N. C.; Iredell Meares, Wilmington, N. C.; S. S. Mann, Swan Quarter, N. C.; A. B. Croom, Jr., Burgaw, N. C.; John Wilkinson, Belhaven, N. C.; Joseph A. Brown, Chadbourn, N. C.; John P. Kerr, Asheville, N. C.; Joseph Hyde Pratt, Chapel Hill, N. C.

This committee held several meetings and then appointed a subcommittee to draft a bill embodying the ideas and suggestions of the committee on the whole and those embodied in the resolutions passed by the Association.

The bill representing the work of the committee was introduced in the House by Hon. W. S. Privott, Representative from Chowan County, and in the Senate by Hon. Joseph A. Brown, Senator from the Twelfth District. The bill was passed and ratified on March 3, 1911.

An error was noted in section 11, which read that the commissioners authorized to use bond issue "to the payment of the interest on said bonds for the two years next following the date of issue," and it should have read "to the payment of the interest on said bonds for the *three* years next following the date of issue." This necessitated a supplemental act making this change, which was introduced by Senator Brown, and passed and ratified on the 8th of March.

A separate bill was introduced by Hon. W. S. Privott, exempting the drainage bonds from taxation for a period of fifteen years. This bill, as passed, exempts drainage bonds for the period of fifteen years from county and municipal taxation.

There is given below the North Carolina Drainage Law as it is in force.

The principal amendments to the law of 1909 are:

Regarding issuance of bonds and payment of interest thereon.

Exempting drainage bonds from taxation.

Fees allowed sheriff and treasurer handling drainage district funds.

Payment of compensation expenses of drainage engineer for preliminary report.

Sale of land on account of nonpayment by owner of drainage assessment.

Agreement of time between railway company and drainage commissioners regarding going under railway with canal.

Regarding maintenance of bridges that have to be constructed across drainage canal.

Method of letting contract.

In order that those who are interested in drainage districts in North Carolina may have the North Carolina Drainage Law in a form convenient for use, there is given below the law codified to date and annotated. That portion of the law passed by the General Assembly of 1909 is given in ordinary type and the amendments of 1911 are given in italics. The chapter, section, and year where the original act can be found are given after each section or paragraph.

NORTH CAROLINA STATE LIBRARY

NORTH CAROLINA DRAINAGE LAW

(CODIFIED).

AN ACT TO PROMOTE THE PUBLIC HEALTH, CONVENIENCE AND WELFARE BY LEVEEING, DITCHING AND DRAINING THE WET, SWAMP AND OVERFLOWED LANDS OF THE STATE, AND PROVIDING FOR THE ESTABLISHMENT OF LEVEE OR DRAINAGE DISTRICTS FOR THE PURPOSE OF ENLARGING OR CHANGING ANY NATURAL WATER COURSES, AND FOR DIGGING DITCHES OR CANALS FOR SECURING BETTER DRAINAGE OR PROVIDING BETTER OUTLETS FOR DRAINAGE, FOR BUILDING LEVEES OR EMBANKMENTS AND INSTALLING TIDE GATES OR PUMPING PLANTS FOR THE RECLAMATION OF OVERFLOWED LANDS, AND PRESCRIBING A METHOD FOR SO DOING; AND PROVIDING FOR THE ASSESSMENT AND COLLECTION OF THE COST AND EXPENSE OF THE SAME, AND ISSUING AND SELLING BONDS THEREFOR, AND FOR THE CARE AND MAINTENANCE OF SUCH IMPROVEMENTS, WHEN CONSTRUCTED.

The General Assembly of North Carolina do enact:

SECTION 1. *Duty and powers of the court.*

Jurisdiction of clerk of superior court.

Levee or drainage districts.

Drainage a public benefit.

The clerk of the Superior Court of any county in the State of North Carolina shall have jurisdiction, power and authority to establish a levee or drainage district or districts in his county, and to locate and establish levees, drains or canals, and cause to be constructed, straightened, widened or deepened any ditch, drain or water course, and to build levees or embankments and erect tide gates and pumping plants for the purpose of draining and reclaiming wet, swamp or overflowed lands; and it is hereby declared that the drainage of swamps and the drainage of the surface water from agricultural lands and the reclamation of tidal marshes shall be considered a public benefit and conducive to the public health, convenience, utility and welfare.

c. 442 (1), 1909.

SEC. 2. *Petition—Bond—Board of viewers.*

Petition for establishment of drainage district.

Whenever a petition signed by a majority of the resident landowners in a proposed drainage district or by the owners of three-fifths of all the land which will be affected by or assessed for the expense of the proposed improvements shall be filed in the office of the clerk of the Superior Court of any county in which a part of said lands are located, setting forth that any specific body or district of land in the county and adjoining counties, described in such a way as to convey an intelligent idea as to the location of such land, is subject to overflow or too wet for cultivation, and the public benefit or utility or the public health, convenience or welfare will be promoted by draining, ditching or leveeing the same, or by changing or improving the natural water courses, and setting forth therein, as far as practicable, the starting point, route and terminus and lateral branches, if necessary, of the proposed improvement, and there is filed therewith a bond for the amount of fifty dollars per mile for each mile of the ditch or proposed improvement, signed by two or more sureties or by some lawful and authorized surety company, to be approved by the clerk of the Superior Court and conditioned for payment of all costs and expenses incurred in the proceedings in case the court does not grant the prayer of said petition, the said clerk shall issue a summons to be served on all the defendant landowners who have not joined in the petition and whose lands are included in the proposed drainage district. Upon the return day the said clerk shall appoint a disinterested and competent civil and drainage engineer and two resident freeholders of the county or counties in which said lands are located as a board of viewers to examine the lands described in the petition and make a preliminary report thereon. Such drainage engineer shall be appointed upon the recommendation of the State Geologist, and the compensation for the services of such engineer and his necessary assistants, to be fixed as herein provided, shall be paid by the State Geological and Economic Survey, said sum or sums so paid to be refunded when the drainage fund is subsequently provided by the sale of bonds or otherwise. When the lands proposed to be drained and created into a drainage district are located in two or more counties the clerk of the Superior Court of either county shall have and exercise the jurisdiction herein conferred, and the venue shall be in that county in which the petition is first filed. The law and rules regulating special proceedings shall be applicable to this act, so far as may be practicable. The summons may be served by publication as to any defendants who cannot be personally served as provided by law.

Bond for cost of proceedings.

Summons to be served on landowners.

Appointment of board of viewers.

Appointment and payment of drainage engineer.

Jurisdiction when land is in more than one county.

Rules of proceeding.

Summons served by publication.

c. 442 (2), 1909.

If at the time of the filing of the petition, or at any time subsequent thereto, it shall be made to appear to the court by affidavit or otherwise that the owner or owners of the whole or any share of any tract or tracts of land whose names are unknown, and cannot after due diligence be ascertained by the petitioners, the court shall order a notice in the nature of a summons to be given to all such persons by a publication of the petition, or of the substance thereof, and describing generally the tract or tracts of land as to which the owner or owners are unknown, with the order of the court thereon, in some newspaper published in the county wherein the land is located, or in some other county, if no newspaper shall be published in the first-named county, which newspaper or newspapers shall be designated in the order of the court, and a copy of such publication shall also be posted in at least three conspicuous places within the boundaries of the proposed district, and at the courthouse door of the county. Such publication in a newspaper and by posting shall be made for a period of four weeks. After

Publication of petition and description of land of unknown owners.

the time of publication shall have expired, if no person claiming and asserting title to the tract or tracts of land and entitled to notice shall appear, the court in its discretion may appoint some disinterested person to represent the unknown owner or owners of said lands, and thereupon the court shall assume jurisdiction of the said tract or tracts of land and shall adjudicate as to the said lands to the same extent as if the true owners were present and represented, and shall proceed against the land itself. If at any time during the pendency of the drainage proceeding the true owner or owners of the lands shall appear in person, they may be made parties defendant of their own motion and without the necessity of personal service, and shall thereafter be considered as parties to the proceeding, but they shall have no right to except to or appeal from any order or judgment theretofore rendered, as to which the time for filing exceptions on notice shall have expired.

Court assumes jurisdiction.

No right of appeal from judgment.

c. 67 (1), 1911.

Payment of compensation of engineers.

That the State Treasurer shall pay the compensation and expenses of the drainage engineer and his necessary assistants as provided in section two of chapter four hundred and forty-two of the General Laws of one thousand nine hundred and nine, according to an itemized statement approved by the clerk of the court to whom the petition for a drainage district was made, and the State Geologist, upon warrant of the State Auditor, out of any money in the State Treasury to the credit of the Department of Agriculture: Provided, that said sum or sums shall be refunded to the State Treasury to the credit of the Department of Agriculture by the petitioners for the drainage district if the drainage district is not established: Provided further, that if the drainage district is established said sum or sums shall be refunded to the State Treasury to the credit of the Department of Agriculture out of the first moneys received from the sale of the bonds of said drainage district: Provided, that the total amount loaned by the State Treasury, out of the funds to the credit of the Department of Agriculture, for the purpose set forth in this section, shall never exceed fifteen thousand dollars ($15,000) at any one time: Provided further, that not more than two thousand dollars shall be advanced to any one district; and Provided further, that before any advancement is made for the purposes herein expressed, the bond of the petitioners required by section two of said chapter shall be first approved by the Attorney-General.

Upon warrant of auditor.

Amount loaned not to exceed $15,000.

c. 67 (14), 1911.

SEC. 3. *Examination—Preliminary report.*

Board of viewers to examine lands and route.

The board of viewers shall proceed to examine the land described in said petition, and other land if necessary to locate properly such improvement or improvements as are petitioned for, along the route described in the petition, or any other route answering the same purpose if found more practicable or feasible, and may make surveys such as may be necessary to determine the boundaries and elevation of the several parts of the district, and shall make and

Surveys.

return to the clerk of the Superior Court within thirty days, unless the time shall be extended by the court, a written report, which shall set forth:

1. Whether the proposed drainage is practicable or not.
2. Whether it will benefit the public health or any public highway or be conducive to the general welfare of the community.
3. Whether the improvement proposed will benefit the lands sought to be benefited.
4. Whether or not all the lands that are benefited are included in the proposed drainage district.

Report to set forth: If drainage is practicable; If drainage will benefit public health or any public highway or conduce to general welfare; If drainage will benefit the specific lands; If all lands to be benefited are included.

They shall also file with this report a map of the proposed drainage district, showing the location of the ditch or ditches or other improvement to be constructed and the lands that will be affected thereby, and such other information as they may have collected that will tend to show the correctness of their findings.

Map to be filed.

Other information.

c. 442 (3), 1909.

Sec. 4. *Filing preliminary report.*

The clerk of the Superior Court shall consider this report. If the viewers report that the drainage is not practicable or that it will not benefit the public health or any public highway or be conducive to the general welfare of the community, and the court shall approve such findings, the petition shall be dismissed at the cost of the petitioners. Such petition or proceeding may again be instituted by the same or additional landowners at any time after six months, upon proper allegations that conditions have changed or that material facts were omitted or overlooked. If the viewers report that the drainage is practicable and that it will benefit the public health or any public highway or be conducive to the general welfare of the community, and the court shall so find, then the court shall fix a day when the report will be further heard and considered.

Clerk to consider report. Petition dismissed if work not reported practicable and beneficial.

Petition renewed after six months.

Day for further hearing if report be favorable.

c. 442 (4), 1909.

Sec. 5. *Notice.*

If the petition is entertained by the court, notice shall be given by publication for two consecutive weeks in some newspaper of general circulation within the county or counties, if one shall be published in such counties, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places within the drainage district that on the date set, naming the day, the court will consider and pass upon the report of the viewers. At least fifteen days shall intervene between the date of the publication and the posting of the notices and the date set for the hearing.

Notice of hearing.

Time of notice.

c. 442 (5), 1909.

Sec. 6. *Hearing preliminary report.*

At the date appointed for the hearing the court shall hear and determine any objections that may be offered to the report of the

Court to hear and determine objections.

Amendments to petition and changes in boundary and location.

viewers. If it appears that there is any land within the proposed levee or drainage district that will not be affected by the leveeing or drainage thereof, such lands shall be excluded and the names of the owners withdrawn from such proceeding; and if it shall be shown that there is any land not within the proposed district that will be affected by the construction of the proposed levee or drain, the boundary of the district shall be so changed as to include such land, and such additional landowners shall be made parties plaintiff or defendant, respectively, and summons shall issue accordingly, as hereinbefore provided. After such change in the boundary is made, the sufficiency of the petition shall be verified, to determine whether or not it conforms to the requirements of the statute as provided in section two. The efficiency of the drainage or levees may also be determined, and if it appears that the location of any levee or drain can be changed so as to make it more effective, or that other branches or spurs should be constructed, or that any branch or spur projected may be eliminated or other changes made that will tend to increase the benefits of the proposed work, such modification and changes shall be made by the board. The engineer and the other two viewers may attend this meeting and give any information or evidence that may be sought to verify and substantiate their report. If necessary, the petition, as amended, shall be referred by the court to the engineer and two viewers for further report. The above facts having been determined to the satisfaction of the court, and the boundaries of the proposed district so determined, it shall declare the establishment of the drainage or levee district, which shall be designated by a name or number, for the object and purpose as herein set forth.

Board of viewers may attend hearing.

Reference of petition for further report.

Establishment of district.

Name or number.

c. 442 (6), 1909.

Lands excluded from district.

If any lands shall be excluded from said district because of the court having found that such lands will not be affected or benefited, and the names of the owners of such lands have been withdrawn from such proceeding, but such lands are so situated as necessarily to be located within the outer boundaries of said district, such fact shall not prevent the establishment of the district, and said lands shall not be assessed for any drainage tax; but this shall not prevent the district from acquiring a right of way across such lands for constructing a canal or ditch or for any other necessary purpose authorized by law.

Right of way across such lands.

c. 67 (2), 1911.

Sec. 7. *May condemn land.*

Power to condemn land.

If it shall be necessary to acquire a right of way or an outlet over and through lands not affected by the drainage, and the same cannot be acquired by purchase, then and in such event the power of eminent domain is hereby conferred, and the same may be condemned. Such owner or owners of the land proposed to be condemned may be made parties defendant in the manner of an ancillary proceeding, and the procedure shall be substantially as provided for the condemnation of rights of way for railroads in

Procedure for condemnation.

chapter sixty-one of the Revisal of one thousand nine hundred and five, so far as the same may be applicable, and such damages as may be awarded as compensation shall be paid by the board of drainage commissioners out of the first funds which shall be available from the proceeds of sale of bonds or otherwise.

Payment of damages.

c. 442 (7), 1909.

SEC. 8. *Right of appeal.*

Any person or corporation owning lands within the drainage or levee district which he or it thinks will not be benefited by the improvement and should not be included in the district may appeal from the decision of the court to the Superior Court of such county, in term-time, by filing an appeal, accompanied by a bond, conditioned for the payment of the costs if the appeal should be decided against him, for such sum as the court may require, not exceeding two hundred dollars, signed by two or more solvent sureties, or in some approved surety company, to be approved by the court.

Appeal to superior court.

Bond on appeal.

c. 442 (8), 1909.

SEC. 9. *Complete survey.*

After the district is established the court shall refer the report of the engineer and viewers back to them to make a complete survey, plans and specifications for the drains or levees or other improvements, and fix a time when said engineer and viewers shall complete and file their report, not exceeding sixty days.

Report referred for complete survey.

Complete report within sixty days.

c. 442 (9), 1909.

SEC. 10. *Complete report.*

The engineer and viewers shall have power to employ such assistants as may be necessary to make a complete survey of the drainage district, and shall enter upon the ground and make a survey of the main drain or drains and all its laterals. The line of each ditch, drain or levee shall be plainly and substantially marked on the ground. The course and distance of each ditch shall be carefully noted and sufficient notes made, so that it may be accurately platted and mapped. A line of levels shall be run for the entire work and sufficient data secured from which accurate profiles and plans may be made. Frequent bench marks shall be established along the line, on permanent objects, and their elevation recorded in the field books. If it is deemed expedient by the engineer and viewers, other levels may be run to determine the fall from one part of the district to another. If an old water course, ditch or channel is being widened, deepened or straightened, it shall be accurately cross-sectioned, so as to compute the amount of cubic yards saved by the use of such old channel. A drainage map of the district shall then be completed, showing the location of the ditch or ditches and other improvements and the boundary, as closely as may be determined by the records of the lands owned by each individual landowner within the district. The location of any railroads or public highways and the boundary of any incorporated towns or villages within the district shall

Board of viewers may employ assistants.

Survey of main drain and laterals.

Detailed instructions for making survey.

Drainage map to be drawn.
Details of map.

Profile to accompany map.

Estimate of cost. Plans, specifications and cost of other work.

be shown on the map. There shall also be prepared to accompany this map a profile of each levee, drain or water course, showing the surface of the ground, the bottom or grade of the proposed improvement and the number of cubic yards of excavation or fill in each mile or fraction thereof, and the total yards in the proposed improvement and the estimated cost thereof, and plans and specifications, and the cost of any other work required to be done.

c. 442 (10), 1909.

Sec. 11. *Assessment of damages.*

Board of viewers to assess claims for damages.

Benefits not considered.

Payment of damages.

It shall be the further duty of the engineer and viewers to assess the damages claimed by any one that is justly right and due to them for land taken or for inconvenience imposed because of the construction of the improvement, or for any other legal damages sustained. Such damage shall be considered separate and apart from any benefit the land would receive because of the proposed work, and shall be paid by the board of drainage commissioners when funds shall come into their hands.

c. 442 (11), 1909.

Sec. 12. *Classification of land according to benefits.*

Board of viewers to examine and classify lands.

Considerations in determining benefit.

Land in five classes, "A," "B," "C," "D," and "E."

Number of acres in each class ascertained.

Total acreage.

Scale of assessment.

It shall be the further duty of the engineer and viewers to personally examine the land in the district and classify it with reference to the benefit it will receive from the construction of the levee, ditch, drain or water course or other improvement. In the case of drainage, the degree of wetness of the land, its proximity to the ditch or a natural outlet and the fertility of the soil shall be considered in determining the amount of benefit it will receive by the construction of the ditch. The land benefited shall be separated into five classes. The land receiving the highest benefit shall be marked "Class A"; that receiving the next highest benefit, "Class B"; that receiving the next highest benefit, "Class C"; that receiving the next highest benefit, "Class D," and that receiving the smallest benefit, "Class E." The holdings of any one landowner need not necessarily be all in one class, but the number of acres in each class shall be ascertained, though its boundary need not be marked on the ground or shown on the map. The total number of acres owned by one person in each class and the total number of acres benefited shall be determined. The total number of acres of each class in the entire district shall be ascertained and presented in tabulated form. The scale of assessment upon the several classes of land returned by the engineer and viewers shall be in the ratio of five, four, three, two and one; that is to say, as often as five mills per acre is assessed against the land in "Class A," four mills per acre shall be assessed against the land in "Class B," three mills per acre in "Class C," two mills per acre in "Class D," and one mill per acre in "Class E." This shall form the basis of the assessment of benefits to the lands for drainage purposes.

c. 442 (12), 1909.

SEC. 13. *Cost of the survey.*

The engineer and viewers shall keep an accurate account and report to the court the name and number of days each person was employed on the survey and the kind of work he was doing and any expenses that may have been incurred in going to and from the work, and the cost of any supplies or material that may have been used in making the survey.

Account kept and reported to court.

c. 442 (13), 1909.

SEC. 14. *Delay—Extension of time.*

In case the work is delayed by high water, sickness or any other good cause, and the report is not completed at the time fixed by the court, the engineer and viewers shall appear before the court and state in writing the cause of such failure and ask for sufficient time in which to complete the work, and the court shall set another date by which the report shall be completed and filed.

Court may extend time for cause shown.

c. 442 (14), 1909.

SEC. 15. *Final report—Notice of hearing.*

When the final report is completed and filed it shall be examined by the court, and if it is found to be in due form and in accordance with the law it shall be accepted, and if not in due form it may be referred back to the engineer and viewers, with instructions to secure further information, to be reported at a subsequent date to be fixed by the court. When the report is fully completed and accepted by the court a date not less than twenty days thereafter shall be fixed by the court for the final hearing upon the report, and notice thereof shall be given by publication in a newspaper of general circulation in the county and by posting a written or printed notice on the door of the courthouse and at five conspicuous places throughout the district, such publication to be made for at least two weeks before the final hearing. During this time a copy of the report shall be on file in the office of the clerk of the Superior Court and shall be open to the inspection of any landowner or other person interested within the district.

Examination of final report.

Time for final hearing.

Notice of final hearing.

Time of publication.

Report open to inspection.

c. 442 (15), 1909.

SEC. 16. *Adjudication—Final report.*

At the date set for hearing any landowner may appear in person or by counsel and file his objection in writing to the report of the viewers; and it shall be the duty of the court to carefully review the report of the viewers and the objections filed thereto, and make such changes as are necessary to render substantial and equal justice to all the landowners in the district. If, in the opinion of the court, the cost of construction, together with the amount of damages assessed, is not greater than the benefits that will accrue to the land affected, the court shall confirm the report of the viewers. If, however, the court finds that the cost of construction, together with the damages assessed, is greater than the resulting benefit that will accrue to the lands affected, the court shall dismiss the proceedings at the cost of the petitioners, and the sureties upon the bond so filed by them shall be liable for such

Landowners may appear in person or by counsel.

Objections in writing.

Court to review report and objections.

Confirmation of report.

Dismissal of proceedings.

Proviso: release of costs of engineer and assistants.

costs: *Provided*, that the State Geological and Economic Survey may remit and release to the petitioners the costs expended by said board on account of the engineer and his assistants. The court may from time to time collect from the petitioners such amounts as may be necessary to pay costs accruing, other than costs of the engineer and his assistants, such amounts to be repaid from the special tax hereby authorized.

Payments on costs.

c. 442 (16), 1909.

SEC. 17. *Appeal.*

Appeal to superior court.

Any party aggrieved may, within ten days after the confirmation of the assessor's report, appeal to the Superior Court in term-time. Such appeal shall be taken and prosecuted as now provided in special proceedings.

c. 442 (17), 1909.

Appeal heard only upon exceptions.

Such appeal shall be based and heard only upon the exceptions theretofore filed by the complaining party, either as to issue of law or fact, and no additional exceptions shall be considered by the court upon the hearing of the appeal.

c. 67 (3), 1911.

SEC. 18. *Drainage record.*

Drainage record.

The clerk of the Superior Court shall provide a suitable book, to be known as the "Drainage Record," in which he shall transcribe every petition, motion, order, report, judgment or finding of the board in every drainage transaction that may come before it, in such a manner as to make a complete and continuous record of the case. Copies of all the maps and profiles are to be furnished by the engineer and marked by the clerk "Official Copies," which shall be kept on file by him in his office, and one other copy shall be pasted or otherwise attached to his record book.

Copies of maps and profiles kept on file.

Copy attached to record book.

c. 442 (18), 1909.

Board of drainage commissioners.

SEC. 19. After the said drainage district shall have been declared established, as aforesaid, and the survey and plan therefor approved, the court shall appoint three persons, who shall be designated as the board of drainage commissioners. Such drainage commissioners shall first be elected by the owners of land within the drainage or levee district, or by a majority of same, in such manner as the court shall prescribe. The court shall appoint those receiving a majority of the votes. If any one or more of such proposed commissioners shall not receive the vote of a majority of such landowners the court shall appoint all or the remainder from among those voted for in the election. Any vacancy thereafter occurring shall be filled in like manner. Such three drainage commissioners, when so appointed, shall be immediately created a body corporate under the name and style of "The Board of Drainage Commissioners of .... District," with the right to hold property and convey the same, to sue and be sued, and shall possess such other powers as usually pertain to corporations. They shall organize by electing from among their num-

Election by landowners.

Appointment by court.

Vacancies.

Drainage commissioners incorporated.

Corporate name.

Corporate powers.

Organization.

ber a chairman and a vice chairman. They shall also elect a secretary, either within or without their body. The treasurer of the county in which the proceeding was instituted shall be *ex officio* treasurer of such drainage commissioners. Such board of drainage commissioners shall adopt a seal, which they may alter at pleasure. The board of drainage commissioners shall have and possess such powers as are herein granted. The name of such drainage district, whether designated by number or otherwise, shall constitute a part of its corporate name; for illustration, "The Board of Drainage Commissioners of (No. 1 or Moyock) District."

Treasurer.

Seal.

c. 442 (19), 1909.

Sec. 20. *Superintendent of construction.*

The board of drainage commissioners shall appoint a competent person as superintendent of construction. Such person shall furnish a bond, to be approved by the commissioners, in the penal sum of ten thousand dollars, conditioned upon the honest and faithful performance of his duties, such bond to be in favor of the board of drainage commissioners.

Superintendent of construction. Bond of superintendent.

c. 442 (20), 1909.

Sec. 21. *Notice of letting contract—Bond.*

The board of drainage commissioners shall cause notice to be given for two consecutive weeks in some newspaper published in the county wherein such improvement is located, if such there be, and such additional publication elsewhere as they may deem expedient, of the time and place of letting the work of construction of said improvement, and in such notice they shall specify the approximate amount of work to be done and the time fixed for the completion thereof; and on the date appointed for the letting, they, together with the superintendent of construction, shall convene and let to the lowest responsible bidder, either as a whole or in sections, as they may deem most advantageous for the district, the proposed work. No bid shall be entertained that exceeds the estimated cost, except for good and satisfactory reasons it shall be shown that the original estimate was erroneous. They shall have the right to reject all bids and advertise again the work, if in their judgment the interest of the district will be subserved by doing so. The successful bidder shall be required to enter into a contract with the board of drainage commissioners and to execute a bond for the faithful performance of such contract, with sufficient sureties, in favor of the board of drainage commissioners for the use and benefit of the levee or drainage district, in an amount equal to twenty-five per centum of the estimated cost of the work awarded to him.

Advertisement for letting of contracts.

Work let to lowest responsible bidder.

Bids exceeding estimate not considered.

Right to reject all bids.

Successful bidder to enter into contract and give bond.

c. 442 (21), 1909.

In canvassing bids and letting the contract, the superintendent of construction shall act only in an advisory capacity to the board of drainage commissioners. The contract shall be based on the plans and specifications submitted by the viewers in their final report as confirmed by the court, the original of which shall re-

Superintendent to act in advisory capacity.

Drainage commissioners have power to correct errors.

main on file in the office of the clerk of the Superior Court and shall be open to the inspection of all prospective bidders. All bids shall be sealed and shall not be opened except under the authority of the board of drainage commissioners and on the day theretofore appointed for opening the bids. The drainage commissioners shall have power to correct errors and modify the details of the report of the engineer and viewers, if in their judgment they can increase the efficiency of the drainage plan and afford better drainage to the lands in the district without increasing the estimated cost submitted by the engineer and viewers and confirmed by the court.

c. 67 (4), 1911.

Sec. 22. *Payment for work done.*

Superintendent to make and file monthly estimates.

Warrants for payments.

Payment of warrants.

Payment in full on completion of work.

The superintendent in charge of construction shall make monthly estimates of the amount of work done, and furnish one copy to the contractor and file the other with the secretary of the board of drainage commissioners; and the commissioners shall, within five days after the filing of such estimate, meet and direct the secretary to draw a warrant in favor of such contractor for ninety per centum of the work done, according to the specifications and contract; and upon the presentation of such warrant, properly signed by the chairman and secretary, to the treasurer of the drainage fund, he shall pay the amount due thereon. When the work is fully completed and accepted by the superintendent he shall make an estimate for the whole amount due, including the amounts withheld on the previous monthly estimates, which shall be paid from the drainage fund as before provided.

c. 442 (22), 1909.

Sec. 23. *Failure of contractor—Reletting.*

Suit on bond of contractor.

Work advertised and relet.

If any contractor to whom said work shall have been let shall fail to perform the same according to the terms specified in his contract, action may be had in behalf of the board of drainage commissioners against such contractor and his bond in the Superior Court for damages sustained by the levee or drainage district, and recovery made against such contractor and his sureties. In such an event the work shall be advertised and relet in the same manner as the original letting.

c. 442 (23), 1909; c. 67 (5), 1911.

Sec. 24. *Right of contractor.*

Right of contractor to enter on lands.

Removal and ownership of timber.

In the construction of the work the contractor shall have the right to enter upon the lands necessary for this purpose and the right to remove private or public bridges or fences and to cross private lands in going to or from the work. In case the right of way of the improvement is through timber the owner thereof shall have the right to remove it, if he so desires, before the work of construction begins, and in case it is not removed by the landowner it shall become the property of the contractor and may be removed by him.

c. 442 (24), 1909.

SEC. 25. *Highways affected.*

Cost of drains across highways.

Highways benefited to be included in report.

Notice of assessment on highways.

Where any public ditch, drain or water course established under the provisions of this act crosses a public highway the actual cost of constructing the same across the highway or removing old bridges or building new ones shall be paid for from the fund of the drainage district. Wherever any highway within the levee or drainage district shall be beneficially affected by the construction of any improvement or improvements in such district it shall be the duty of the viewers appointed to classify the land to give in their report the amount of benefit to such highway, and notice shall be given by the clerk of the Superior Court to the clerk of the board of county commissioners in the county where the road is located of the amount of such assessment, and the county commissioners shall have the right to appear before the court and file its objections, the same as any landowner.

c. 442 (25), 1909.

Repair or construct bridge.

Maintained at expense of county.

When it shall become necessary for the drainage commissioners to repair any bridge or construct a new bridge across a highway by reason of enlarging any water course, or of excavating any canal intersecting such highway, the said bridge shall thereafter be maintained by and at the expense of the board of commissioners of such county, or by such other official board or authority as by law shall be required to maintain such highway so intersected.

c. 67 (6), 1911.

SEC. 26. *Railroad—Damage—Benefit.*

Procedure to determine place and manner of crossing right of way of railroad companies.

Agreement.

Procedure in case of disagreement.

Whenever the engineer and the viewers in charge shall make a survey for the purpose of locating a public levee or drainage district or changing a natural water course, and the same would cross the right of way of any railroad company, it shall be the duty of the owner in charge of the work to notify the railroad company, by serving written notice upon the agent of such company or its lessee or receiver, that they will meet the company at the place where the proposed ditch, drain or water course crosses the right of way of such company, said notice fixing the time of such meeting, which shall not be less than ten days after the service of the same, for the purpose of conferring with said railroad company with relation to the place where and the manner in which such improvement shall cross such right of way. When the time shall arrive fixed for such conference, unless for good cause more time is agreed upon, it shall be the duty of the viewers in charge and the railroad company to agree, if possible, upon the place where and the manner and method in which such improvement shall cross such right of way. If the viewers in charge and the railroad company cannot agree, or if the railroad company shall fail, neglect or refuse to confer with the viewers, they shall determine the place and manner of crossing the right of way of said railroad company, and shall specify the number and size of openings required, and the damages, if any, to said rail-

Facts not considered as damages.

road company, and so specify in their report. The fact that the railroad company is required by the construction of the improvement to build a new bridge or culvert or to enlarge or strengthen an old one shall not be considered as damages to said railroad company. The engineer and viewers shall also assess the benefits that will accrue to the right of way, roadbed and other property of said company by affording better drainage or a better outlet for drainage, but no benefits shall be assessed because of the increase in business that may come to said road because of the construction of the improvement. The benefits shall be assessed at a fixed sum, determined solely by the physical benefit that its property will receive by the construction of said improvement, and it shall be reported by the viewers as a special assessment, due personally from the railroad company as a special assessment; it may be collected in the manner of an ordinary debt in any court having jurisdiction.

Benefits to be assessed.

Assessment at a fixed sum.

c. 442 (26), 1909.

SEC. 27. *Notice to railroad.*

Notice of final hearing to be served on railroad company.

The clerk of the Superior Court shall have notice served upon the railroad company of the time and place of the meeting to hear and determine the final report of the engineer and viewers, and the said railroad company shall have the right to file objections to said report and to appeal from the findings of the board of commissioners in the same manner as any landowner. But such an appeal shall not delay or defeat the construction of the improvement.

c. 442 (27), 1909.

SEC. 28. *Manner of crossing right of way—Penalty for delay—Cost.*

Notice to railroad company of time of work.

After the contract is let and the actual construction is commenced, if the work is being done with a floating dredge, the superintendent in charge of construction shall notify the railroad company of the probable time at which the contractor will be ready to enter upon the right of way of said road and construct the work thereon. It shall be the duty of said railroad to send a representative to view the ground with the superintendent of construction and arrange the exact time at which such work can be most conveniently done. At the time agreed upon the said railroad company shall remove its rails, ties, stringers and such other obstructions as may be necessary to permit the dredge to excavate the channel across its right of way. The work shall be so planned and conducted as to interfere in the least possible manner with the business of said railroad. *If the superintendent of construction and the railroad company shall not be able to agree as to the exact time at which such work can be done, including the time of beginning and the time to be consumed in such work, either party may give written notice thereof to the chairman of the Corporation Commission of the State, and thereupon the said Corporation Commission shall cause an investigation to be made, and, after hearing both parties, shall fix the time of beginning such work and the time to be consumed in such work of construction,*

Time to be agreed on.

Railroad company to remove obstructions.

Corporation commission shall fix time in case of disagreement.

and the final determination of the Corporation Commission thereon shall be binding upon the superintendent of construction representing the district and the railroad company, and the work shall be done in such time as may be fixed by the said Corporation Commission. In case the railroad company refuses and fails to remove its track and allow the dredge to construct the work on its right of way it shall be held as delaying the construction of the improvement, and such company shall be liable to a penalty of twenty-five dollars per day for each day of delay, to be collected by the board of drainage commissioners for the benefit of the drainage district as in the case of other penalties. Such a fine may be collected in any court having jurisdiction and shall inure to the benefit of the drainage district. Within thirty days after the work is completed, an itemized bill for the actual expenses incurred by the railroad company for opening its tracks shall be made and presented to the superintendent of construction of the drainage improvement. Such bill, however, shall not include the cost of putting in a new bridge or strengthening or enlarging an old one. The superintendent of construction shall audit this bill and, if found correct, approve the same and file it with the secretary of the board of drainage commissioners. The commissioners shall deduct from this bill the cost of the excavation done by the dredge on the right of way of said railroad company at the contract price, and pay the difference, if any, to said railroad company.

Refusal to remove obstructions and permit work a delay of construction. Penalty.

Railroad company to present itemized bill.

Superintendent to audit bill.

Cost of excavation deducted and bill paid.

c. 442 (28), 1909; c. 67 (7), 1911.

Sec. 29. *Control and repairs.*

Whenever any improvement constructed under this act is completed it shall be under the control and supervision of the board of drainage commissioners. It shall be the duty of the said board to keep the levee, ditch, drain or water course in good repair, and for this purpose they may levy an assessment on the lands benefited by the construction of such improvement in the same manner and in the same proportion as the original assessments were made, and the fund that is collected shall be used for repairing and maintaining the ditch, drain or water course in perfect order: *Provided, however*, that if any repairs are made necessary by the act or negligence of the owner of any land through which such improvement is constructed or by the act or negligence of his agent or employee, or if the same is caused by the cattle, hogs or other stock of said owner, employee or agent, then the cost thereof shall be assessed and levied against the lands of said owner alone, to be collected by proper suit instituted by the drainage commissioners. It shall be unlawful for any person to injure or damage or obstruct or build any bridge, fence or flood gate in such a way as to injure or damage any levee, ditch, drain, or water course constructed or improved under the provisions of this act, and any person causing such injury shall be guilty of a misdemeanor, and upon conviction thereof may be fined in any sum not exceeding twice the damage or injury done or caused.

Completed work to be under control of drainage commissioners. Duty to maintain work.

Assessment for maintenance and repairs.

Proviso: repairs made necessary by negligence.

Injury to works a misdemeanor.

Punishment.

c. 442 (29), 1909.

Sec. 30. *Outlet for lateral drains.*

Rights of owners of assessed lands.

Procedure for condemnation of access to drain.

The owner of any land that has been assessed for the cost of the construction of any ditch, drain or water course, as herein provided, shall have the right to use the ditch, drain or water course as an outlet for lateral drains from said land; and if said land is separated from the ditch, drain or water course by the land of another or others, and the owner thereof shall be unable to agree with said other or others as to the terms and conditions on which he may enter their lands and construct said drain or ditch, he may file his ancillary petition in such pending proceeding to the court, and the procedure shall be as now provided by law. When the ditch is constructed it shall become a part of the drainage system and shall be under the control of the board of drainage commissioners and be kept in repair by them as herein provided.

c. 442 (30), 1909.

Sec. 31. *Assessment-tax roll and amount to be assessed.*

Ascertainment of amount to be assessed.

*After the classification of lands and the ratio of assessments of the different classes to be made thereon has been confirmed by the court, the board of drainage commissioners shall ascertain the total cost of the improvement, including damages awarded to be paid to owners of land, all costs and incidental expenses, and also including an amount sufficient to pay the necessary expenses of maintaining the improvement for a period of three years after the completion of the work of construction, after deducting therefrom any special assessments made against any railroad or highway, and, thereupon, the board of drainage commissioners, under the hand of the chairman and secretary of the board, shall certify to the clerk of the Superior Court the said total cost, ascertained as aforesaid; and the said certificate shall be forthwith recorded in the drainage record and open to inspection of any landowner in the district.**

c. 67 (8), 1911.

---

*Section 31 of chapter 442 of 1909 was amended by striking out the section and inserting the above in lieu thereof. The following is a copy of the original section:

Sec. 31. *Assessment-tax roll.*

After the classification of the land and the ratio of assessment of the different classes to be made thereon has been confirmed by the court, the drainage commissioners shall prepare an assessment roll or drainage-tax duplicate, giving a description of all the land in said drainage district, the name of the owner, so far as can be ascertained from the public records, and the amount of assessment against each of the several tracts of land. In preparing this assessment roll the board shall ascertain the total cost of the improvement, including the damages awarded and to be paid to the owners of land, and all incidental expenses, and deduct therefrom any special assessment made against any railroad or highway, and the remainder shall be the amount to be borne and paid by the lands benefited. This amount shall be assessed against the several tracts of land according to the benefit received, as shown by the classification and ratio of assessment made by the viewers and confirmed by the board of drainage commissioners. This drainage-tax roll shall be made in duplicate, signed by the chairman and secretary, and one copy filed with the drainage record and the other delivered to the sheriff or other county tax collector. There shall be appended an order to collect the said assessments, and the same shall have the force and effect of a judgment as in the case of State and county taxes.

SEC. 31. *Continued.*

The board of drainage commissioners shall immediately prepare, in duplicate, the assessment rolls, or drainage tax lists, giving thereon the names of the owners of land in the district, so far as can be ascertained from the public records, a brief description of the several tracts of land assessed, and the amount of the assessment against each tract of land. The first of these assessment rolls shall provide assessments sufficient for the payment of interest on the bond issue to accrue the third year after their issue and the instalment of principal to fall due at the expiration of the third year after the date of issue, together with such amounts as shall have to be paid for collection and handling of the same. The second assessment roll shall make like provision for the fourth year; the third for the fifth year; the fourth for the sixth year; the fifth for the seventh year; the sixth for the eighth year; the seventh for the ninth year; the eighth for the tenth year; the ninth for the eleventh year; the tenth for the twelfth year. Each of said assessment rolls shall specify the time when collectible and be numbered in their order, and the amounts assessed against the several tracts of land shall be in accordance with the benefits received, as shown by the classification and ratio of assessments made by the viewers. These assessment rolls shall be signed by the chairman of the board of drainage commissioners and by the secretary of the board. One copy of each of the said assessment rolls shall be filed with the drainage record and one copy shall be delivered to the sheriff, or other county tax collector, after the clerk of the Superior Court has appended thereto an order directing the collection of said assessments, and the said assessments shall thereupon have the force and effect of a judgment as in the case of State and county taxes. These assessments shall constitute a first and paramount lien, second only to State and county taxes, upon the lands assessed for the payment of said bonds and interest thereon as they become due, and shall be collected in the same manner by the same officers as the State and county taxes are collected. The said assessments shall be due and payable on the first Monday in September each year, and if the same shall not be paid in full by the thirty-first day of December following, it shall be the duty of the sheriff or tax collector to sell the land or lands so delinquent. The sale of lands for failure to pay such assessments shall be made at the courthouse door of the county in which the lands are situated, between the hours of ten o'clock in the forenoon and four o'clock in the afternoon of the first Monday in February of each year; and if for any necessary cause the sale cannot be made on that date, the sale may be continued from day to day for not exceeding four days, or the lands may be re-advertised and sold on the first Monday in March succeeding, during the same hours, without any order therefor. In all other respects, except as to time of sale of lands, the existing law as to the collection of State and county taxes shall have application to the collection of drainage assessments under this act. It shall be the duty

Drainage commissioners to prepare assessment-tax rolls.
Drainage-tax roll in duplicate.

First assessment roll.

Second assessment roll.

Time when collectible.

Rolls, how signed.

Order to collect assessment.

Lien on lands.

Assessments, when due.

Sale of land for nonpayment of assessment.

How advertised.

Duty of sheriff.

of the sheriff or tax collector to pay over to the county treasurer promptly the moneys so collected by him upon said tax assessments, to the end that the said treasurer may have funds in hand to meet the payments of interest and principal due upon the outstanding bonds as they mature. It shall be the duty of the county treasurer, and without any previous order from the board of drainage commissioners, to provide and pay the instalments of interest at the time and place as evidenced by the coupons attached to said bonds, and also to pay the annual instalments of the principal due on said bonds at the time and place as evidenced by the said bonds, and the said county treasurer shall be guilty of a misdemeanor and subject upon conviction to a fine and imprisonment, in the discretion of the court, if he shall wilfully fail to make prompt payments of the said interest and principal upon said bonds, and shall likewise be liable in a civil action for all damages which may accrue either to the board of drainage commissioners or the holder of said bonds, to either or both of which a right of action is hereby given.

Duty of county treasurer.

c. 67 (12), 1911.

SEC. 32. *Time of payment.**

If the total cost of the improvement is less than an average of twenty-five cents per acre on all the land in the district, the board of drainage commissioners shall forthwith assess the lands in the district therefor, in accordance with their classification, and said assessment shall be collected in one instalment, by the same officer and in the same manner as State and county taxes are collected, and payable at the same time. In case the total cost exceeds an average of twenty-five cents per acre on all lands in the district, the board of drainage commissioners shall give notice for three weeks by publication in some newspaper published in a county in which the district, or some part thereof, is situated, if there be any such newspaper, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places in the district, reciting that they propose to issue bonds for the payment of the total cost of the improvement, giving the amount

Assessment payable in one instalment.

Advertisement of purpose to issue drainage bonds.

---

*Section 32 of chapter 442 of 1909 was amended by striking out the section and adding the above. Original section is given below:

SEC. 32. *Time of payment.*

If the total cost of the work is less than an average of twenty-five cents per acre on all the land in the district the assessment made against the several tracts shall be collected in one instalment, by the same officer and in the same manner as State and county taxes are collected, and payable at the same time. In case the total assessment exceeds the average of twenty-five cents per acre on all the lands in the district the said board of drainage commissioners may give notice of three weeks by publication in some newspaper of general circulation in the district, if there be one, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places in the drainage district, that they propose to issue bonds for the construction of said improvement, giving the amount of bonds to be issued, the rate of interest they are to bear and the time when payable. Any landowner having lands assessed in the district and not wanting to pay interest on the bonds may, within thirty days after the publication of said notice, pay the county treasurer the full amount of his assessment and have his land released therefrom.

of bonds to be issued, the rate of interest that they are to bear and the time when payable. Any landowner in the district not wanting to pay interest on the bonds may, within fifteen days after the publication of said notice, pay to the county treasurer the full amount for which his land is liable, to be ascertained from the classification sheet and the certificate of the board showing the total cost of the improvement, and have his lands released from liability to be assessed for the said improvement; but such land shall continue liable for any future assessment for maintenance or for any increased assessment authorized under the law.
c. 67 (9), 1911.

Land released on payment of assessment.

Liability for future assessments.

Sec. 33. *Defense—Waiver.**

Each and every person owning land in the district who shall fail to pay to the county treasurer the full amount for which his land is liable, as aforesaid, within the time above specified, shall be deemed as consenting to the issuance of drainage bonds, and in consideration of the right to pay his proportion in instalments he hereby waives his right of defense to the payment of any assessments which may be levied for the payment of bonds, because of any irregularity, illegality, or defect in the proceedings prior to this time, except in case of an appeal, as hereinbefore provided, which is not affected by this waiver. The term "person" as used in this act includes any firm, company, or corporation.
c. 67 (10), 1911.

Failure to pay assessment.

Waiver of right of defense.

Sec. 34. *Bond issue.*

At the expiration of fifteen days after publication of notice of bond issue, the board of drainage commissioners may issue bonds of the drainage district for an amount equal to the total cost of the improvement, less such amounts as shall have been paid in in cash to the county treasurer, plus an amount sufficient to pay interest on the bond issue for the three years next following the date of issue. These bonds shall bear six per cent interest per annum, payable semi-annually, and shall be paid in ten equal instalments. The first instalment of principal shall mature at the expiration of three years from the date of issue, and one instalment for each succeeding year for nine additional years. The commissioners may sell these bonds at not less than par and devote the proceeds to the payment for the work as it progresses and to the payment of the

Bond issue authorized. Amount.

Interest.

Maturity.

First instalment.

Sale of bonds.

---

*Section 33 of chapter 442 of 1909, given below, was amended by striking out the section and adding in lieu thereof section 33, above.

Sec. 33. *Defense—Waiver.*

Each and every person owning land in the district which is assessed for the construction of an improvement, who shall neglect or fail to pay the full amount of his assessment to the county treasurer within the time specified, shall be deemed as consenting to the issuing of said drainage bonds, and in consideration of the right to pay his assessment in instalments he hereby waives his right to any defense against the collection of said assessment because of any irregularity, illegality, or defect in the proceedings prior to this time, except in the case of an appeal, as heretofore provided, which is not affected by this waiver. The term "person," as used in this act, includes any firm, company, or corporation.

Proceeds of bonds, how expended.

Mandamus for levy of assessment to meet instalments of bonds.

Suits on official bonds.

interest on said bonds for the three years next following the date of issue and to the payment of the other expenses of the district provided for in this act. The proceeds from such bonds shall be for the exclusive use of the levee or drainage district specified on their face, and shall be numbered by the board of drainage commissioners and recorded in the drainage record, which record shall set out specifically the lands embraced in the district on which the tax has not been paid in full, which land is to be assessed as hereafter provided. If any instalment of principal or interest represented by the said bond shall not be paid at the time and in the manner when the same shall become due and payable, and such default shall continue for a period of six months, the holder or holders of such bond or bonds upon which default has been made may have a right of action against said drainage district or the board of drainage commissioners of said district, wherein the court may issue a writ of mandamus against the said drainage district, its officers, including the tax collector and treasurer, directing the levying of a tax or special assessment as herein provided, and the collection of same, in such sum as may be necessary to meet any unpaid instalments of principal and interest and cost of action; and such other remedies are hereby vested in the holder or holders of such bond or bonds in default as may be authorized by law; and the right of action is hereby vested in the holder or holders of such bond upon which default has been made, authorizing them to institute suit against any officer on his official bond for failure to perform any duty imposed by the provisions of this act. The official bonds of the tax collector and county treasurer shall be liable for the faithful performance of the duties herein assigned them. Such bonds may be increased by the board of county commissioners.*†
c. 67 (11), 1911.

---

*This originally read "two," but the following act was passed, changing it to "three":

AN ACT SUPPLEMENTAL TO H. B. 1800 AND S. B. 789 OF THE GENERAL ASSEMBLY OF 1911.

The General Assembly of North Carolina do enact:

SECTION 1. That House Bill one thousand eight hundred and Senate Bill seven hundred and eighty-nine of the General Assembly of one thousand nine hundred and eleven, which was ratified the third day of March, one thousand nine hundred and eleven, be amended by striking out the word "two" before the word years, in line six of page ten of said bill, and substituting therefor the word "three."

SEC. 2. That this act shall be in force from and after its ratification.

Ratified this the 8th day of March, A. D. 1911.

†Section 34 of chapter 442 of 1909 was amended by striking out the section and adding in lieu thereof the above. The original section was as follows:

SEC. 34. *Bond issue.*

At the expiration of the thirty days after the publication the board of drainage commissioners may issue bonds for the full amount of the assessment not paid in to the county treasurer, together with the interest thereon, costs of collection or other incidental expenses. These bonds shall bear six per cent interest per annum, payable annually, and shall be paid in ten equal annual instalments. The first instalment of the principal shall mature at the expiration of three years from the date of issue, and one instalment each succeeding year for nine additional years. The commissioners may sell these bonds at not less than par and devote the proceeds to the payment of the work as it progresses. In no case shall bonds be issued

SEC. 34. *Continued.*

*That the bonds and coupons issued under and by authority of section thirty-four of chapter four hundred and forty-two of the Public Laws of one thousand nine hundred and nine shall during the years one thousand nine hundred and eleven to one thousand nine hundred and twenty-five exclusive be exempt from all county or municipal taxation or assessment, direct or indirect, general or special, whether imposed for purposes of general revenue or otherwise, and the interest thereon shall not be subject to taxation as for income, nor shall said bonds and coupons be subject to taxation when constituting a part of the surplus of any bank, trust company, or other corporation, but when constituting a part of such surplus shall be deducted from the total assets in order to ascertain the taxable value of such shares.**

Bonds exempt from taxation.

c. 177 (1), 1911.

SEC. 34½. *Fees allowed sheriff and treasurer.*

That the fee allowed the sheriff or other county tax collector for collecting the drainage tax as prescribed in section thirty-four of chapter four hundred and forty-two of the Public Laws of one thousand nine hundred and nine shall be two per cent of the amount collected, and the fee allowed the county treasurer for disbursing the revenue obtained from the sale of the drainage bonds shall be one per cent of the amount disbursed: Provided, no fee shall be allowed the sheriff or other county tax collector or county treasurer for collecting or receiving the revenue obtained from the sale of the bonds provided for in section thirty-four of chapter four hundred and forty-two of the Public Laws of one thousand nine hundred and nine, nor for disbursing the revenue raised for paying

Sheriff's fee.

Treasurer's fee.

---

until the tax levy has been made to meet them as they come due. The bonds issued shall be for the exclusive use of the levee or drainage district specified on their face, and should be numbered by the board of drainage commissioners and recorded in the drainage record, which record shall set out specifically the lands embraced in the district on which the tax has not been paid in full, and which land is assessed for the payment of the bonds issued and the interest thereon. This assessment shall constitute the first and paramount lien, second only to State and county taxes, upon the lands assessed for the payment of said bonds and the interest thereon as they become due, and shall be collected in the same manner by the same officers as the State and county taxes are collected. If any instalment of principal or interest represented by the said bond shall not be paid at the time and in the manner when the same shall become due and payable, and such default shall continue for a period of six months, the holder or holders of such bond or bonds upon which default has been made may have a right of action against said drainage district or the board of drainage commissioners of said district, wherein the court may issue a writ of *mandamus* against the said drainage district, its officers, including the tax collector and treasurer, directing the levying of a tax or special assessment as herein provided, and the collection of the same, in such sum as may be necessary to meet any unpaid instalments of principal and interest and cost of action; and such other remedies are hereby vested in the holder or holders of such bond or bonds in default as may be authorized by law; and the right of action is hereby vested in the holder or holders of such bond upon which default has been made authorizing them to institute suit against any officer on his official bond for failure to perform any duty imposed by the provisions of this act. The official bonds of the tax collector and county treasurer shall be liable for the faithful performance of the duties herein assigned them. Such bonds may be increased by the board of county commissioners.

*This part of the act was ratified on the 8th of March, 1911.

When fees not allowed.

off the said bonds: Provided further, that in those counties where the sheriff or tax collector and treasurer are on a salary basis, no fees whatever shall be allowed for collecting or disbursing the funds of the drainage district.

c. 67 (13), 1911.

SEC. 35. *Relevy.*

Power to change or modify assessment.

Where the court has confirmed an assessment for the construction of any public levee, ditch or drain, and such assessment has been modified by the court of superior jurisdiction, but for some unforeseen cause it cannot be collected, the board of drainage commissioners shall have power to change or modify the assessment as originally confirmed to conform to the judgment of the Superior Court and to cover any deficit that may have been caused by the order of said court or unforeseen occurrence. The said relevy shall be made for the additional sum required, in the same ratio on the lands benefited as the original assessment was made.

c. 442 (35), 1909.

Failure to pay annual assessment.

Sale of land.

New assessment roll.

Lands sold for taxes remain on assessment roll.

If any person, or any number of persons, claiming to have title to any tract or tracts of land subject to assessment or drainage tax shall fail to pay any annual assessment levied against such lands, and the sheriff or tax collector shall be compelled to sell such lands under the law for the purpose of making such collection, the net proceeds of such sale shall be paid to the county treasurer, to be held by him and disbursed for the purpose of paying the current assessment and future annual assessments so far as the said proceeds may be sufficient. When the fund in the custody of the treasurer shall be exhausted in the payment of annual assessments against such lands, or there shall not be a sufficient sum to pay the next annual assessment, the county treasurer shall immediately give written notice to that effect to the chairman of the board of drainage commissioners of the district, and also to the clerk of the Superior Court, whereupon the board of drainage commissioners shall institute an investigation of said tract or tracts of land to determine its market value, and if they shall find that its market value is not equal to all the future annual assessments to cover its share of instalments of principal and interest on the outstanding bonds, they shall proceed, with the approval of the clerk of the Superior Court, to make new reassessment rolls on all the remaining lands in the district and increase the sum in sufficient sums to equal the deficit thereby created, and such new assessment rolls shall constitute the future assessment rolls until changed according to law, and shall be certified to the tax collector as herein provided in lieu of the former assessment rolls. However, the said tract or tracts of land which have been so sold by the tax collector shall continue on the assessment roll in the name of the new owner, but reassessed upon the new basis, and the drainage tax collected at the same time and in the same manner as other lands as long as said lands may have sufficient market value *out of which to collect the annual drainage tax, and when such lands shall cease to have such value, or shall be abandoned by the person claiming title thereto, the drainage commissioners may omit the same from the assessment roll with the approval of the clerk of the Superior Court; but the said lands may in the same manner at any time in the future be restored to the assessment rolls. If the funds in the hands of the county treasurer at any time, arising under this section or in any other manner, shall be greater than is necessary to pay the annual instalments of principal and interest, or the annual cost of maintenance of the drainage works, or both, such surplus shall be held by the county treasurer for future disbursement for other purposes as herein provided or subject to the order of the board of drainage commissioners. If there shall be any impairment or destruction of the drainage works by any unforeseen cause or occurrence not anticipated, during the period of construction by the contractor, the said contractor shall nevertheless repair and complete the said works according to the contract and specifications, and shall be liable therefor and also his sureties on his bond; but if said contractor shall make default and if there shall be a failure to collect all resulting damages from such contractor and the sureties upon his bond, and it shall thereby be necessary to raise a greater sum of money to complete the drainage works in accordance with the plans, or if for any other unavoidable cause it shall be necessary to raise a greater sum to complete such drainage works, the board of drainage commissioners, having first obtained the approval of the clerk of the Superior Court, shall prepare new assessment rolls upon all the lands in the district upon the original basis of classification of benefits, and increase the same in sufficient sums to equal the deficit thereby created, and the same shall constitute the new assessment rolls until changed according to law, and shall be certified to the tax collector as herein provided. If for any of the causes hereinbefore recited in this section or for any other cause, a sum of money greater than the proceeds of sale of the drainage bonds shall become necessary to complete said drainage system, and the board of drainage commissioners shall determine that the amount to be raised is greater than can be realized from the collection of one annual assessment upon the lands in the district without imposing an undue burden upon said lands, or if it is advisable or necessary to raise the money more expeditiously, then and under such conditions additional bonds may be issued in such aggregate sum as may be necessary. The proceedings for the issue of such additional bonds shall be substantially as follows: The board of drainage commissioners shall file their petition with the clerk of the Superior Court, setting forth all the facts which require the expenditure of more money and the issue of additional bonds to complete the drainage system, which shall be accompanied by the recommendation of the drainage engineer, who was one of the original viewers, or some other expert drainage engineer selected by the*

Funds greater than necessary for work; how surplus shall be used.

Default of contractor.

Necessity of raising greater sum than first obtained.

Additional issue of bonds.

Show cause why additional bonds should not be issued.

Order of court authorizing bond issue.

Appeal.

Not to exceed twenty-five per cent.

drainage commissioners; whereupon the court shall issue a notice to all the owners of land within the district, reciting the substance of the petition and directing each to appear before the court on a day certain, not less than twenty days after the service upon all the parties, and to show cause, if any they have, why the additional bonds should not be authorized, which notice shall be served personally on each such landowner by reading the same, and by leaving a copy, and, if the same cannot be personally served, then it shall be served in the manner authorized by law. Any landowner may file an answer denying any material allegation in the petition or setting forth any valid objection to same before the return day thereof. Upon the day when said notice is returnable, or on such day as to which the same may have been continued, the court shall proceed to hear the petition and answers. If the court shall find that the allegations of the petition are true and that the issue of additional bonds is advisable or necessary the court shall make an appropriate order authorizing and directing the issue of such additional bonds, fixing the amount of such issue, the date of same, the time when the interest and principal shall be payable, and all other matters necessary and appropriate in the premises. Any landowner may appeal from the order of the clerk of the Superior Court, and on such appeal only the issues raised in the answer shall be considered, and such appeal and the further procedure thereon shall be as prescribed in special proceedings, except as modified by the act of which this is amendatory. After the court shall have ordered the additional issue of bonds, the further procedure as to the assessment rolls, the levying and collecting of the drainage taxes, the disbursement of the revenue therefrom for the payment of said bonds and interest thereon, and all further procedure shall be the same as required by chapter four hundred and forty-two of the Public Laws of one thousand nine hundred and nine, and amendments thereto, for the establishment of drainage districts. The additional bonds issued shall not exceed twenty-five per cent of the total amount originally issued. The additional issue of bonds shall bear six per cent interest per annum and may be made payable in ten annual instalments, or lesser number of annual instalments as nearly equal as may be, as recommended by the board of drainage commissioners and approved by the court.
c. 67 (15), 1911.

SEC. 36. *Fees and expenses.*

Pay of engineer.

Viewers, other than engineer.

Rodmen and other laborers.

Fees and costs as prescribed by law.

Any engineer employed under the provisions of this act shall receive such compensation per diem for his services as shall be fixed and determined by the drainage commissioners. The viewers, other than the engineer, shall receive three dollars per day; the rodmen, axmen, chainmen and other laborers shall receive not to exceed two dollars per day each. All other fees and costs incurred under the provisions of this act shall be the same as provided by law for like services in other cases. Said costs and expenses shall be paid, by the order of the court, out of the drainage fund provided for that purpose, and the board of drainage commissioners shall issue warrants therefor when funds shall be in the hands of the treasurer.

c. 442 (36), 1909.

SEC. 37. *Defects in proceedings.*

The provisions of this act shall be liberally construed to promote the leveeing, ditching, draining and reclamation of wet and overflowed lands. The collection of the assessment shall not be defeated, where the proper notices have been given, by reason of any defect in the proceedings occurring prior to the order of the court confirming the final report of the viewers; but such order or orders shall be conclusive and final that all prior proceedings were regular and according to law, unless they were appealed from. If on appeal the court shall deem it just and proper to release any person or to modify his assessment or liability, it shall in no manner affect the rights and legality of any person other than the appellant, and the failure to appeal from the order of the court within the time specified shall be a waiver of any illegality in the proceedings, and the remedies provided for in this act shall exclude all other remedies.

Act to be liberally construed.

Order confirming final report conclusive.

Modification on appeal to affect appellant only.

Failure to appeal a waiver.

c. 442 (37), 1909.

SEC. 38. Proceedings under this act may be *ex parte* or adversary. Any engineer, viewer, superintendent of construction or other person appointed under this act may be removed by the court, upon petition, for corruption, negligence of duties or other good and satisfactory cause shown.

Proceedings ex parte.

Removal of officers or employees for cause.

c. 442 (38), 1909.

SEC. 38½. This act shall not repeal or change any local drainage laws already enacted or to be enacted by the General Assembly of one thousand nine hundred and nine.

Local drainage laws not affected.

c. 442 (38½), 1909.

SEC. 39. All laws in conflict with this act are hereby repealed: *Provided,* that proceedings now pending by virtue of any statute now or heretofore in force in this State in any county shall not be affected by this act, but that such proceedings may be continued in accordance with such statute or in accordance with the provisions of this act.

Repealing clause.

Proviso: proceedings pending not affected.

c. 442 (39), 1909.

SEC. 40. This act shall be in effect from and after its ratification.

Ratified this the 5th day of March, A. D. 1909.*

c. 442 (40), 1909.

SEC. 41. *That this act shall apply to all drainage proceedings which may be pending at the date of its ratification and to all drainage districts heretofore established for which the bonds of said district have not been issued at the date of its ratification, so*

Application of act.

---

*This refers to all those portions of the acts given above that are not in italics.

Drainage proceedings instituted but not completed.

far as the same may be applicable. Such of the provisions of this act as refer to parts or stages of drainage proceedings which have been instituted but not completed shall apply to the parts or stages of such proceedings which may occur subsequent to the ratification of this act, including duties imposed upon the board of drainage commissioners, the court, the sheriff or tax collector and county treasurer and others after the confirmation of the final report of the viewers: Provided the same are not inconsistent with the preceding acts and decrees in any pending proceeding; and Provided further, that no vested right theretofore acquired shall be impaired. Subject to the foregoing provisions of this section, this act shall be in effect from and after its ratification.

Proviso: vested rights not impaired.

*Ratified this the 3d day of March, A. D. 1911.**

c. 67 (16), 1911.

---

*This refers to all the acts given above in italics except as otherwise mentioned.

DECISION BY SUPREME COURT OF NORTH CAROLINA REGARDING THE VALIDITY OF NORTH CAROLINA DRAINAGE BONDS.

In order to determine the validity of the bonds issued by authority of the North Carolina Drainage Law, a test case relating to the bonds of the Moyock Drainage District, No. 1, was tried. This case was heard by consent of parties before Judge G. W. Ward at chambers in Elizabeth City, on May 12, 1910. The decision of the Superior Court was that the bonds were valid. The case was taken to the Supreme Court of North Carolina and was argued at the February Term, 1910, the case being known as *Sanderlin v. Luken et al.*, reported in 152 N. C., 738. The judgment of the Superior Court was affirmed, the decision being written by Justice Hoke. There is given below a copy of this decision.

DECISION BY SUPREME COURT OF NORTH CAROLINA REGARDING VALIDITY OF NORTH CAROLINA DRAINAGE BONDS.

CIVIL ACTION, heard by consent of parties before *Ward, J.*, at chambers, in Elizabeth City, on May 12, 1910.

The facts relevant to the controversy, and the questions presented for decision, are very well stated in the brief of counsel for appellants, as follows:

"This is a case involving the constitutionality of the act of the General Assembly of North Carolina of 1909, chapter 442, authorizing the establishment of levee or drainage districts; of the validity of bonds which the commissioners of a drainage district, purporting to have been established under the act, have contracted to issue; and also of the action of the commissioners in letting the contract for the construction of the work to one who was not the lowest bidder, in view of the provision of the statute requiring the contract to be let to the 'lowest responsible bidder.'

"Under the statute, a petition for the establishment of a drainage district in Currituck County was presented to the clerk of the Superior Court, and after proceedings duly taken was declared to be established as the Moyock District, No. 1. The plaintiff herein is a citizen, taxpayer, and landowner within the boundaries of the district, and his lands have been assessed, for the costs of the improvements to be made, under the classification of the lands embraced in the district according to the provisions of the statutes. The plaintiff has brought this suit to restrain the commissioners of the drainage district from issuing bonds contracted for to defray the costs and expenses of the proposed improvements.

"Upon the case being brought to a hearing, it was adjudged by the court below that the act of 1909, chapter 442, is valid and that the proceedings of the commissioners were regular, and that the plaintiff was not entitled to the injunction prayed for. An appeal was taken and has been duly perfected.

"The following propositions, involving the constitutionality of the statute and the validity of the bonds, and also the action of the commissioners in letting the contract, are submitted to the Court:

"1. Conferring upon the clerk of the Superior Court the power to establish a levee or drainage district is invalid as constituting a delegation of legislative power and duty to the judiciary.

"2. The statute shows upon its face that it is for the benefit of private landowners and not for a public purpose.

"3. As a levee or drainage district is a *quasi*-municipal corporation and the work is not a 'necessary expense,' within the meaning of Article VII, section 7, of the Constitution of North Carolina, a debt cannot be contracted 'unless by a vote of the majority of the qualified voters therein.'

"4. The contract should have been let to the lowest bidder in this case or the work should have been advertised for new bids.

"The foregoing propositions, so far as they involve the validity of the statute, are pointed to the provisions of the State and the United States constitutions, declaring that the legislative, executive, and supreme judicial powers of the Government ought to be forever separate and distinct from each other; that no person ought to be deprived of his property but by the law of the land or by due process of law; and that no municipal corporation shall contract any debt except for the necessary expenses thereof, unless by a vote of the majority of the qualified voters therein."

J. H. McMullan and T. H. Calvert for plaintiff.
Pruden & Pruden and Brown Shepherd for defendant.

HOKE, J. The power of the Legislature to create special taxing districts for public purposes, separate and distinct from the ordinary political subdivisions of the State, such as counties, townships, etc., was declared and approved in the case of *Smith v. School Trustees*, 141 N. C., 143, and like power to create special assessment districts has been upheld by the Court in several well-considered decisions. *Asheville v. Trust Co.*, 143 N. C., 360; *Busbee v. Commissioners of Wake*, 93 N. C., 143; *Commissioners v. Commissioners*, 92 N. C., 180; *Shuford v. Commissioners*, 86 N. C., 552; *Newsome v. Earnheart*, 86 N. C., 391; *Cain v. Commissioners*, 86 N. C., 8.

The principle has been frequently extended and applied to the creation of these drainage districts, and while certain statutes may have been declared void, this as a rule was because the rights of persons affected had not been in some way sufficiently safeguarded, and, so far as we have examined, the power of the General Assembly to enact legislation of this character has not been questioned. *Adams v. Joyner*, 147 N. C., 77; *Porter v. Armstrong*, 139 N. C., 179; *Pool v. Trexler*, 76 N. C., 297; *Norfleet v. Cromwell*, 70 N. C., 634; *Fall Brook v. Bradley*, 164 U. S., 112; *Warts v. Hoagland*, 114 U. S., 606; *Land and Stock Co. v. Miller*, 170 Mo., 240; *Morrison v. Morey*, 146 Mo., 543; *Lagima Drainage Dist. v. Mastin Co.*, 144 Cal., 209; *Cribbs v. Benedict*, 64 Kan., 555; *Bryant v. Robbins*, 70 Wis., 258.

Speaking of such legislation, and the reasons upon which it may be made to rest, *Rodman, J.*, delivering the opinion in *Norfleet v. Cromwell, supra,* said:

"The defendant takes higher ground, and contends that the act of 1795 was unconstitutional, because it took his property *for a mere private purpose.* It is admitted that that cannot be lawfully done, and the only question on this point is as to the character of the purpose: whether it was to the benefit of one or of a limited number of individuals only, or of such general and public utility as justifies a State in the exercise of its power of eminent domain.

"It is well known that in the Atlantic section of this State there are hundreds of thousands of acres of what are called swamp lands, which, from the flatness of their surface and the filling up of the natural courses of drainage, if any ever existed, cannot be relieved of the water which ordinarily covers them, and made fit for human habitation and cultivation, except by cutting artificial canals from them into some convenient creek or river, which must necessarily pass through the intervening lands of the riparian proprietors. If these canals can be cut only by permission of the owners of the banks of the necessary outlets, this vast area of fertile land must remain for ages an uncultivated and unpopulated wilderness, and it will be entirely valueless to those who bought it from the State on the faith of its laws. An act which aims to remedy so great an evil, affecting so many persons now living and so many more in the future, must be deemed one of general and public utility. In an agricultural view, it now benefits the whole population of that part of the State in which these swamps are found. The right of the State to condemn lands for drains rests on the same foundation as its right in cases of public roads, mills, railroads, cartways, schoolhouses, forts, lighthouses, etc. In the case of public roads, it has never been doubted, and the weight of authority is decidedly in favor of its existence for the other purposes mentioned. Roads and aqueducts are classed together in the Institutes as servitudes of the same public character. In the swamps which the act in question chiefly affects, the canals are more important than the roads, as they must always precede them. The right to drain through the banks of a natural water course is exactly similar in character to the right to construct dykes or levees to keep their excessive waters from overflowing the adjacent lands—a right which has been recognized in the legislation of all countries from the most ancient times. Witness the dykes which protect the coast of Holland, the fens of Lincolnshire, the lands on the Mississippi and on the Po. Both purposes are classed together in our act of 1789.

"The act in question, and others of a like character respecting mills, etc., are of ancient date. They have been incidentally sanctioned by this Court in many decisions, and if their constitutionality has never been directly affirmed, it may be because it was never questioned. These acts are not peculiar to North Carolina. Acts concerning mills, similar to ours, exist in many of the States. (Washburn Easements, 394 [329]), and respecting drainage, at least, in Massachusetts (Gen. Stat., ch. 148), and New York (2 Rev. St., 548; *People v. Nearing*, 27 N. Y. [13 Smith], 306)."

The legislation in question here comes well within the principle established by these cases. It has evidently been prepared with great care, and seems to present a scheme for the drainage of these lowlands at once comprehensive, adequate, and efficient, and in which the rights of all persons to be affected have been fully considered and protected.

When these drainage districts are created under statutes like this we are now considering, they are regarded as public *quasi*-corporations, partaking to some extent of the character of a governmental agency, and for general purposes of taxation in the ordinary acceptation of the term, they come, as a rule, within the restrictions established by the Constitution upon municipal corporations in reference to the imposition of taxes, both as to the amount and method. *Smith v. Trustees, supra.* But under our decisions these restrictive provisions as to taxation have been held not to apply to the case of local assessments, where, as in this case, such assessments are made and collected by some recognized method apportioning the burdens according to the benefits received by the property affected. *Busbee v. Commissioners, supra; Commissioners v. Commissioners, supra; Shuford v. Commissioners, supra; Newsome v. Earnheart, supra; Cain v. Commissioners, supra.*

In *Shuford's case* it was held: "1. A tax levied only upon land under the provisions of the 'stock law' (Laws 1879, ch. 135) is not within the constitutional prohibition as to uniformity of taxation, and hence the assent of the qualified voters of the district affected is not necessary; and this, even though the act of the Legislature styles it a *tax*.

"2. It is regarded as a local assessment, and made with reference to special benefits derived from the property assessed, from the expenditures, while taxes are public burdens, imposed as burdens, for the purpose of general revenue."

And in *Commissioners v. Commissioners*, 92 N. C., *supra*, *Chief Justice Smith*, on this subject, quotes with approval from the opinion in *Cain v. Commissioners* as follows:

"As the greater burden is thus removed from the landowner, he, as such, ought to bear the expense by which this result is brought about. The special interest benefited by the law is charged with the payment of the sum necessary in securing the benefit. This and no more is what the statute proposes to do, and in this respect is obnoxious to no just objection from the taxed land proprietor, as it is *free from any constitutional* impediments."

The objection urged, therefore, that no vote of the people on the proposition was required or provided for by the statute, must be overruled.

Nor can the further objection be sustained, that the act in question improperly undertakes to confer legislative power and duties on the clerk of the court, a judicial officer; for, on authority the duties and powers conferred on the clerk by this statute are of a judicial nature.

Speaking to this question, in 10 A. and E., at page 239, it is said:

"The better doctrine, however, seems to be that the duties of the municipal authorities, in determining the necessity for sewers (dependent on a like principle), their location and their general plan, are of a judicial or *quasi*-judicial nature, while the work of construction and maintenance is ministerial."

And authoritative decisions fully support the position as stated. *Johnston v. District of Columbia*, 118 U. S., 19; *Callen v. City*, 43 Kans., 627; *Bellingham Imp. Co. v. City*, 20 Wash., 53; *Wahoo v. Dickenson*, 23 Neb., 426. This disposes, we believe, of the objections urged against the validity of the statute.

It was further contended for plaintiff that, under the provisions of the law, the commissioners had no right to accept and award the contract to a higher bidder, but that "the contract should have been let to the lowest bidder, or the work should have been advertised for new bids"; but the language of the statute is that "they, together with the superintendent of construction, shall convene and let to the lowest *responsible* bidder," and the decisions are to the effect that when, by the clear import of this or similar language, a discretion is conferred, the action of the authorities will not be interfered with, unless the same was influenced or procured by fraud. *People v. Kent*, 160 Ill., 655; *Brick and Pav. Co. v. Philadelphia*, 164 Pa. St., 477; *Commonwealth v. Mitchell*, 82 Pa. St., 343; *Clapton v. Taylor*, 49 Mo. App., 117.

In *People v. Kent* it was held:

"1. The word 'responsible,' applied to an undertaking to pay money only, means financial ability; but in the statute for letting contracts for public improvements, which requires a 'responsible bidder,' it has the wider meaning of ability to respond to the requirements of the contract, having full regard to the subject-matter thereof.

"2. The requirement of a statute that contracts for a public improvement shall be let to the lowest *responsible* bidder does not require the letting of a contract to the lowest bidder upon the ascertainment of his *financial* responsibility only, but the term 'responsible' includes the ability to respond by the discharge of the contractor's obligations in accordance with what may be expected or demanded under the terms of the contract.

"3. The courts cannot interfere, in the absence of fraud, with the exercise of the official discretion of a public officer intrusted with the duty of awarding a contract, in determining whether a certain person was the lowest responsible bidder, after investigation of such person's record in doing similar business before."

And in *Clapton v. Taylor, supra:*

"2. In letting contracts for street improvements, the duty of city authorities is not wholly ministerial, but partakes sufficiently of a judicial character, in the absence of fraud or misconduct, to render their conclusion binding; and the law in regard to the letting of such contracts does not mean absolutely that the contract shall be given to the lowest bidder without regard to fitness, and the city authorities are presumed to have done, and not to have exceeded, their duty."

The case was submitted for our decision near the close of the term, with a request that an early decision be rendered, and we may have written somewhat hurriedly. Our investigations, however, have been very much facilitated by the excellent briefs submitted by counsel for both parties, and we desire to express appreciation of the commendable diligence they have shown in their preparation, and the great aid these briefs have been to the Court in reaching a satisfactory conclusion on the questions presented.

For the reasons stated, we are of the opinion that the judgment of his Honor below must be affirmed, and it is so ordered.

Affirmed.

NORTH CAROLINA STATE LIBRARY

PUBLICATIONS

OF THE

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY.

BULLETINS.

1. Iron Ores of North Carolina, by Henry B. C. Nitze, 1893. 8°, 239 pp., 20 pl., and map. *Postage 10 cents.*

2. Building and Ornamental Stones in North Carolina, by T. L. Watson and F. B. Laney in collaboration with George P. Merrill, 1906. 8°, 283 pp., 32 pl., 2 figs. *Postage 25 cents. Cloth-bound copy 30 cents extra.*

3. Gold Deposits in North Carolina, by Henry B. C. Nitze and George B. Hanna, 1896. 8°, 196 pp., 14 pl., and map. *Out of print.*

4. Road Material and Road Construction in North Carolina, by J. A. Holmes and William Cain, 1893. 8°, 88 pp. *Out of print.*

5. The Forests, Forest Lands and Forest Products of Eastern North Carolina, by W. W. Ashe, 1894. 8°, 128 pp., 5 pl. *Postage 5 cents.*

6. The Timber Trees of North Carolina, by Gifford Pinchot and W. W. Ashe, 1897. 8°, 227 pp., 22 pl. *Postage 10 cents.*

7. Forest Fires: Their Destructive Work, Causes and Prevention, by W. W. Ashe, 1895. 8°, 66 pp., 1 pl. *Postage 5 cents.*

8. Water-powers in North Carolina, by George F. Swain, Joseph A. Holmes and E. W. Myers, 1899. 8°, 362 pp., 16 pl. *Postage 16 cents.*

9. Monazite and Monazite Deposits in North Carolina, by Henry B. C. Nitze, 1895. 8°, 47 pp., 5 pl. *Postage 4 cents.*

10. Gold Mining in North Carolina and other Appalachian States, by Henry B. C. Nitze and A. J. Wilkins, 1897. 8°, 164 pp., 10 pl. *Postage 10 cents.*

11. Corundum and the Basic Magnesian Rocks of Western North Carolina, by J. Volney Lewis, 1895. 8°, 107 pp., 6 pl. *Postage 4 cents.*

12. History of the Gems Found in North Carolina, by George Frederick Kunz, 1907. 8°, 60 pp., 15 pl. *Postage 8 cents. Cloth-bound copy 30 cents extra.*

13. Clay Deposits and Clay Industries in North Carolina, by Heinrich Ries, 1897. 8°, 157 pp., 12 pl. *Postage 10 cents.*

14. The Cultivation of the Diamond-back Terrapin, by R. E. Coker, 1906. 8°, 67 pp., 23 pl., 2 figs. *Postage 6 cents.*

15. Experiments in Oyster Culture in Pamlico Sound, North Carolina, by Robert E. Coker, 1907. 8°, 74 pp., 17 pl., 11 figs. *Postage 6 cents.*

16. Shade Trees for North Carolina, by W. W. Ashe, 1908. 8°, 74 pp., 10 pl., 16 figs. *Postage 6 cents.*

17. Terracing of Farm Lands, by W. W. Ashe, 1908. 8°, 38 pp., 6 pl., 2 figs. *Postage 4 cents.*

18. Bibliography of North Carolina Geology, Mineralogy and Geography, with a list of Maps, by Francis Baker Laney and Katherine Hill Wood, 1909. 8°, 428 pp. *Postage 25 cents.*

19. The Tin Deposits of the Carolinas, by Joseph Hyde Pratt and Douglass B. Sterrett, 1905. 8°, 64 pp., 8 figs. *Postage 4 cents.*

20. Water-powers of North Carolina: An Appendix to Bulletin 8, 1910. 8°, 383 pp. *Postage 25 cents.*

21. The Gold Hill Mining District of North Carolina, by Francis Baker Laney, 1910. 8°, 137 pp., 23 pl., 5 figs. *Postage 15 cents.*

22. A Report on the Cid Mining District, Davidson County, N. C., by J. E. Pogue, Jr., 1911. 8°, 144 pp., 22 pl., 5 figs. *Postage 15 cents.*

ECONOMIC PAPERS.

1. The Maple-sugar Industry in Western North Carolina, by W. W. Ashe, 1897. 8°, 34 pp. *Postage 2 cents.*

2. Recent Road Legislation in North Carolina, by J. A. Holmes. *Out of print.*

3. Talc and Pyrophyllite Deposits in North Carolina, by Joseph Hyde Pratt, 1900. 8°, 29 pp., 2 maps. *Postage 2 cents.*

4. The Mining Industry in North Carolina During 1900, by Joseph Hyde Pratt, 1901. 8°, 36 pp., and map. *Postage 2 cents.*

Takes up in some detail Occurrences of Gold, Silver, Lead and Zinc, Copper, Iron, Manganese, Corundum, Granite, Mica, Talc, Pyrophyllite, Graphite, Kaolin, Gem Minerals, Monazite, Tungsten, Building Stones, and Coal in North Carolina.

5. Road Laws of North Carolina, by J. A. Holmes. *Out of print.*

6. The Mining Industry in North Carolina During 1901, by Joseph Hyde Pratt, 1902. 8°, 102 pp. *Postage 4 cents.*

Gives a List of Minerals found in North Carolina; describes the Treatment of Sulphuret Gold Ores, giving Localities; takes up the Occurrence of Copper in the Virgilina, Gold Hill, and Ore Knob districts; gives Occurrence and Uses of Corundum; a List of Garnets, describing Localities; the Occurrence, Associated Minerals, Uses and Localities of Mica; the Occurrence of North Carolina Feldspar, with Analyses; an extended description of North Carolina Gems and Gem Minerals; Occurrences of Monazite, Barytes, Ocher; describes and gives Occurrences of Graphite and Coal; describes and gives Occurrences of Building Stones, including Limestone; describes and gives Uses for the various forms of Clay; and under the head of "Other Economic Minerals" describes and gives Occurrences of Chromite, Asbestos and Zircon.

7. Mining Industry in North Carolina During 1902, by Joseph Hyde Pratt, 1903. 8°, 27 pp. *Postage 2 cents.*

8. The Mining Industry in North Carolina During 1903, by Joseph Hyde Pratt, 1904. 8°, 74 pp. *Postage 4 cents.*

Gives descriptions of Mines worked for Gold in 1903; descriptions of Properties worked for Copper during 1903, together with assay of ore from Twin-Edwards Mine; Analyses of Limonite ore from Wilson Mine; the Occurrence of Tin; in some detail the Occurrences of Abrasives; Occurrences of Monazite and Zircon; Occurrences and Varieties of Graphite, giving Methods of Cleaning; Occurrences of Marble and other forms of Limestone; Analyses of Kaolin from Barber Creek, Jackson County, North Carolina.

9. The Mining Industry in North Carolina During 1904, by Joseph Hyde Pratt, 1905. 8°, 95 pp. *Postage 4 cents.*

Gives Mines Producing Gold and Silver during 1903 and 1904 and Sources of the Gold Produced during 1904; describes the mineral Chromite, giving Analyses of Selected Samples of Chromite from Mines in Yancey County; describes Commercial

Varieties of Mica, giving the manner in which it occurs in North Carolina, Percentage of Mica in the Dikes, Methods of Mining, Associated Minerals, Localities, Uses; describes the mineral Barytes, giving Method of Cleaning and Preparing Barytes for Market; describes the use of Monazite as used in connection with the Preparation of the Bunsen Burner, and goes into the use of Zircon in connection with the Nernst Lamp, giving a List of the Principal Yttrium Minerals; describes the minerals containing Corundum Gems, Hiddenite and Other Gem Minerals, and gives New Occurrences of these Gems; describes the mineral Graphite and gives new Uses for same.

10. Oyster Culture in North Carolina, by Robert E. Coker, 1905. 8°, 39 pp. *Postage 2 cents.*

11. The Mining Industry in North Carolina During 1905, by Joseph Hyde Pratt, 1906. 8°, 95 pp. *Postage 4 cents.*

Describes the mineral Cobalt and the principal minerals that contain Cobalt; Corundum Localities; Monazite and Zircon in considerable detail, giving Analyses of Thorianite; describes Tantalum Minerals and gives description of the Tantalum Lamp; gives brief description of Peat Deposits; the manufacture of Sand-lime Brick; Operations of Concentrating Plant in Black Sand Investigations; gives Laws Relating to Mines, Coal Mines, Mining, Mineral Interest in Land, Phosphate Rock, Marl Beds.

12. Investigations Relative to the Shad Fisheries of North Carolina, by John N. Cobb, 1906. 8°, 74 pp., 8 maps. *Postage 6 cents.*

13. Report of Committee on Fisheries in North Carolina. Compiled by Joseph Hyde Pratt, 1906. 8°, 78 pp. *Postage 4 cents.*

14. The Mining Industry in North Carolina During 1906, by Joseph Hyde Pratt, 1907. 8°, 144 pp., 20 pl., and 5 figs. *Postage 10 cents.*

Under the head of "Recent Changes in Gold Mining in North Carolina," gives methods of mining, describing Log Washers, Square Sets, Cyanide Plants, etc., and detailed descriptions of Gold Deposits and Mines are given; Copper Deposits of Swain County are described; Mica Deposits of Western North Carolina are described, giving Distribution and General Character, General Geology, Occurrence, Associated Minerals, Mining and Treatment of Mica, Origin, together with a description of many of the mines; Monazite is taken up in considerable detail as to Location and Occurrence, Geology, including classes of Rocks, Age, Associations, Weathering, method of Mining and Cleaning, description of Monazite in Original Matrix.

15. The Mining Industry in North Carolina During 1907, by Joseph Hyde Pratt, 1908. 8°, 176 pp., 13 pl., and 4 figs. *Postage 15 cents.*

Takes up in detail the Copper of the Gold Hill Copper District; a description of the Uses of Monazite and its Associated Minerals; descriptions of Ruby, Emerald, Beryl, Hiddenite, and Amethyst Localities; a detailed description with Analyses of the Principal Mineral Springs of North Carolina; a description of the Peat Formations in North Carolina, together with a detailed account of the Uses of Peat and the Results of an Experiment Conducted by the United States Geological Survey on Peat from Elizabeth City, North Carolina.

16. Report of Convention called by Governor R. B. Glenn to Investigate the Fishing Industries in North Carolina, compiled by Joseph Hyde Pratt, State Geologist, 1908. 8°, 45 pp. *Postage 4 cents.*

17. Proceedings of Drainage Convention held at New Bern, North Carolina, September 9, 1908. Compiled by Joseph Hyde Pratt, 1908. 8°, 94 pp. *Postage 5 cents.*

18. Proceedings of Second Annual Drainage Convention held at New Bern, North Carolina, November 11 and 12, 1909, compiled by Joseph Hyde Pratt, and containing North Carolina Drainage Law, 1909. 8°, 50 pp. *Postage 3 cents.*

19. Forest Fires in North Carolina During 1909, by J. S. Holmes, Forester, 1910. 8°, 52 pp., 9 pl. *Postage 5 cents.*

20. Wood-using Industries of North Carolina, by Roger E. Simmons, under the direction of J. S. Holmes and H. S. Sackett, 1910. 8°, 74 pp., 6 pl. *Postage 7 cents.*

21. Proceedings of the Third Annual Drainage Convention, held under Auspices of the North Carolina Drainage Association; and the North Carolina Drainage Law (codified). Compiled by Joseph Hyde Pratt, 1911. 8°, 67 pp., 3 pl. *Postage 5 cents.*

VOLUMES.

Vol. I. Corundum and the Basic Magnesian Rocks in Western North Carolina, by Joseph Hyde Pratt and J. Volney Lewis, 1905. 8°, 464 pp., 44 pl., 35 figs. *Postage 32 cents. Cloth-bound copy 30 cents extra.*

Vol. II. Fishes of North Carolina, by H. M. Smith, 1907. 8°, 453 pp., 21 pl., 188 figs. *Postage 30 cents.*

Vol. III. The Physiography and Geography of the Coastal Plain Region of North Carolina. *In Press.*

BIENNIAL REPORTS.

First Biennial Report, 1891-1892, J. A. Holmes, State Geologist, 1893. 8°, 111 pp., 12 pl., 2 figs. *Postage 6 cents.*

Administrative report, giving Object and Organization of the Survey; Investigations of Iron Ores, Building Stone, Geological Work in Coastal Plain Region, including supplies of drinking-waters in eastern counties, Report on Forests and Forest Products, Coal and Marble Investigations of Diamond Drill.

Biennial Report, 1893-1894, J. A. Holmes, State Geologist, 1894. 8°, 15 pp. *Postage 1 cent.*

Administrative report.

Biennial Report, 1895-1896, J. A. Holmes, State Geologist, 1896. 8°, 17 pp. *Postage 1 cent.*

Administrative report.

Biennial Report, 1897-1898, J. A. Holmes, State Geologist, 1898. 8°, 28 pp. *Postage 2 cents.*

Administrative report.

Biennial Report, 1899-1900, J. A, Holmes, State Geologist, 1900. 8°, 20 pp. *Postage 2 cents.*

Administrative report.

Biennial Report, 1901-1902, J. A. Holmes, State Geologist, 1902. 8°, 15 pp. *Postage 1 cent.*

Administrative report.

Biennial Report, 1903-1904, J. A. Holmes, State Geologist, 1905. 8°, 32 pp. *Postage 2 cents.*

Administrative report.

Biennial Report, 1905-1906, Joseph Hyde Pratt, State Geologist, 1907. 8°, 60 pp. *Postage 3 cents.*

Administrative report; report on certain swamp lands belonging to the State, by W. W. Ashe; it also gives certain magnetic observations at North Carolina stations.

Biennial Report, 1907-1908, Joseph Hyde Pratt, State Geologist, 1908. 8°, 60 pp., 2 pl. *Postage 5 cents.*

Administrative report. Gives special report on an Examination of the Sand-banks along the North Carolina Coast, by Jay F. Bond, Forest Assistant, United States Forest Service; certain magnetic observations at North Carolina stations; Results of an Investigation Relating to Clam Cultivation, by Howard E. Enders of Purdue University.

Biennial Report, 1909-1910, Joseph Hyde Pratt, State Geologist, 1911. 8°, 152 pp. *Postage 10 cents.*

Administrative report, and contains Agreements for Co-operation in Statistical Work, and Topographical and Traverse Mapping Work with the United States Geological Survey; Forest Work with the United States Department of Agriculture (Forest Service); List of Topographic maps of North Carolina and counties partly or wholly topographically mapped; description of special Highways in North Carolina; suggested Road Legislation; list of Drainage Districts and Results of Third Annual Drainage Convention; Forestry reports relating to Connolly Tract; Buncombe County, Transylvania County State Farm, certain Watersheds, Reforestation of Cut-over and Abandoned Farm Lands, on the Woodlands of the Salem Academy and College; Recommendations for the Artificial Regeneration of Longleaf Pine at Pinehurst; Act regulating the use of and for the Protection of Meridian Monuments and Standards of Measure at the several county-seats in North Carolina; list of Magnetic Declination at the county-seats, January 1, 1910; letter of Fish Commissioner of the United States Bureau of Fisheries relating to the conditions of the North Carolina fish industries; report of the Survey for the North Carolina Fish Commission referring to dutch or pound-net fishing in Albemarle and Croatan sounds and Chowan River, by Gilbert T. Rude, of the United States Coast and Geodetic Survey; Historical Sketch of the several North Carolina Geological Surveys, with list of publications of each.

Samples of any mineral found in the State may be sent to the office of the Geological and Economic Survey for identification, and the same will be classified free of charge. It must be understood, however, that NO ASSAYS, OR QUANTITATIVE DETERMINATIONS, WILL BE MADE. Samples should be in a lump form if possible, and marked plainly on outside of package with name of sender, post-office address, etc.; a *letter* should accompany sample and *stamp* should be enclosed for reply.

These publications are mailed to libraries and to individuals who may desire information on any of the special subjects named, free of charge, except that in each case applicants for the reports should forward the amount of *postage* needed, as indicated above, for mailing the bulletins desired, to the *State Geologist, Chapel Hill, N. C.*